Program: BCA
Semester: Second
Course: Data Structure and Algorithms
Course Code: 3C.153

L	T	P	C
3	0	0	3

Course Objective:

- Argue the correctness of algorithms using inductive proofs and invariants.
- Analyze worst-case running times of algorithms using asymptotic analysis.
- Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it.
- Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it.
- Describe the greedy paradigm and explain when an algorithmic design situation calls for it. Explain the major graph algorithms and their analyses.
- Explain the different ways to analyze randomized algorithms (expected running time, probability of error). Recite algorithms that employ randomization.
- Analyze randomized algorithms. Employ indicator random variables and linearity of expectation to perform the analyses. Recite analyses of algorithms that employ this method of analysis.

Unit I:

Time and Space complexity of algorithms, average case and worst case analysis, asymptotic notation as a measure of algorithm complexity, O and Θ notations.

Unit II:

Arrays: Representation of single and multidimensional arrays; sparse arrays -lower and upper triangular matrices and Tri -diagonal matrices. Analysis of sorting algorithms- Selection sort, Bubble sort, Insertion sort, Heap sort, Quick sort and analysis of searching algorithms – linear search and binary search. Stacks and Queues: Introduction and primitive operations on stack; Stack application: Infix, postfix, prefix expressions; Evaluation of postfix expression; Conversion from infix to postfix. Introduction and primitive operation on queues, D-queues and priority queues.

Unit III:

Lists: Introduction to linked lists; Sequential and linked lists, operations such as traversal, insertion, deletion, searching, two way lists and Use of headers. Trees: Introduction and terminology; Traversal of binary trees; Recursive algorithms for tree operations such as traversal, insertion, deletion.

Unit IV:

Multilevel indexing and B-Trees: Introduction: The invention of the B- tree; Statement of the problem; Indexing with binary search trees; Multilevel indexing, a better approach to tree indexes; B -trees: working up from the bottom; Example for creating a B -tree.

Suggested Readings:

1. E. Horowitz and S. Sahani, “Fundamentals of Data Structures”, Galgotia Booksource Pvt. Ltd, 2003
2. R. S. Salaria, “Data Structure & Algorithms”, Khanna Book Publishing Co. (P) Ltd., 2002.
3. P. S. Deshpande and O.G. Kakde, “C & Data Structure”, Wiley Dreamtech, 1st Edition, 2003.
4. Y. Langsam et. al., “Data Structures using C and C++”, PHI, 1999.
5. Schaum’s outline series, “Data Structure”, TMH, 2002

JHARKHAND Rai University

Program: BCA
Semester: Second
Course: Data Structure Lab
Course Code: 3CP.153

L	T	P	C
0	0	2	1

Course Objective:

- To develop skills to design and analyze simple linear and nonlinear data structures
- To Strengthen the ability to identify and apply the suitable data structure for the given real world problem
- To design and analyze the time and space efficiency of the data structure
- To Gain knowledge in practical applications of data structures

Program:

1. To read and display n numbers using an array.
2. To find transpose a 3 X 3 matrix.
3. To insert a number at a given location in an array.
4. To delete a number from a given location in an array.
5. To create a linked list and perform insertions a) at beginning b) at end c) before a given node d) after a given node
6. To create a linked list and perform deletions a) from beginning b) from end c) at a given node d) After a given node
7. To create a circular linked list and perform insertion at the beginning of list.
8. To create a circular linked list and perform insertion at the end of list.
9. To create a circular linked list and perform deletion from the beginning of list.
10. To create a circular linked list and perform deletion from the end of list.
11. To perform Push, Pop and Peep operations on a stack.
12. To implement a linear queue.
13. To implement a linked queue.
14. To implement a priority queue.
15. To implement a Binary Search tree and perform the following:
    a) Insert Element b) Preorder Traversal
16. To implement a Binary Search tree and perform the following:
    a) Insert Element b) Post-order Traversal
17. To search an element in an array using linear search technique.
18. To search an element in an array using binary search technique.
19. To sort an array using insertion sort algorithm.
20. To implement quick sort algorithm.

Program: BCA
Semester: Second
Course: Operating Systems
Course Code: 3C.154

L	T	P	C
4	0	0	4

Course Objective:

- Describe how computing resources (such as CPU and memory) are managed by the operating system, describe the basic principles used in the design of modern operating systems.
- Explain the objective and functions of modern operating systems, explain memory hierarchy and cost-performance trade-offs, explain the operation, implementation and performance of modern operating systems, and the relative merits and suitability of each for complex user applications
- Compare and contrast the common algorithms used for both pre-emptive and non-pre-emptive scheduling of tasks in operating systems, such a priority, performance comparison, and fair-share schemes. Contrast kernel and user mode in an operating system
- Evaluate and report appropriate design choices when solving real-world problems
- Analyze the key trade-offs between multiple approaches to operating system design.

Unit I:

Introduction: What is an operating system, batch systems, multi programmed, time-sharing systems, personal-computer systems, parallel systems, distributed systems, real-time systems?
Processes: Process Concept, Thread, design issues of thread, user space thread and kernel space thread. Usage of thread. Process states, Operation on Processes: - creation and termination. Implementation of process: process table. Process Synchronization.

Unit II:

Scheduling: Basic Concepts, preemptive and non preemptive scheduling. Scheduling Algorithms. Types of scheduling: - batch, interactive and real-time. Goals of scheduling algorithms. FCFS, SJF, RR, priority, multiple queues, three-level scheduling.
Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock. Banker's algorithm.

Unit III:

Memory management: Multiprogramming. Address binding (relocation), and protection. Swapping. Virtual memory: - logical versus physical address space, paging, page fault, page table and its entries, demand paging, multi level page table, TLB, its entries and working. Page replacement algorithms: LRU, optimal, NRU, FIFO, second chance, clock, NFU. Working set. What is segmentation, what are its benefits and drawbacks.

Unit IV:

File system: What is file, file naming, file types(directory, regular, device), sequential access and random access files, file attributes, operations on file, hierarchical directory structure, path name(relative and absolute), operation on directories, disk layout, disk partition, file system layout, disk block allocation:-contiguous allocation linked list allocation,
I/O management: Basic principles and overall structure of I/O management subsystem, Device controllers, layers of the I/O subsystem: - interrupt handlers device driver, device independent I/O software and user space I/O software.

Suggested Readings:

1. Operating Systems, Galvin, John Wiley
2. Operating Systems , Milankovic, TMH
3. An Introduction to Operating System, Bhatt,PHI
4. Modern Operating System, Tannenbaum,PHI
5. Guide to Operating Systems, Palmer, VIKAS

Program: BCA
Semester: Second
Course: VB.Net
Course Code: 3C.155

L	T	P	C
3	0	0	3

Course Objective:

- Have gained a good understanding of the basic concepts of object orientation
- Have a good understanding of the Visual Basic language structure and language syntax
- Have developed the ability to design and develop interactive applications using the object-oriented principals, encapsulation, inheritance and to some extents polymorphism
- Be able to effectively develop applications with full functionality and a graphical user interface using the language Visual Basic.
- Have the capability of analyzing and finding suitable and effective solutions to Windows based applications using classes and objects.

Unit I:

Introduction to .NET framework, Common Language Runtime, .NET Framework Class Library, Need of .NET, familiarization with visual studio .NET IDE, The editor, Solution Explorer, Properties window, output window and command window, Toolbox

Unit II:

Different .NET Languages, Variables and constant, operators, Conditional Statement and looping statement, String functions, Math functions, formatting data, go to statement

Unit III:

Array, Functions, Sub procedures, Recursion, OOP Concept, Advantages of OOP, Creating object instances in VB.Net, TypeName and TypeOf, Building own classes, Constructor

Unit IV:

Windows forms: Anchor and dock properties, Taborder menu, MDI form, Context menus, Color dialog, Font dialog, File dialog boxes, Adding controls at runtime

Suggested Readings:

1. Programming VB.Net: A guide for experienced programmers, Gary Cornell and Jonathan Morrison, a press.
2. Microsoft Visual Basic .NET Step by Step, Michael Halvorson, Microsoft Press

JHARKHAND Rai University

Program: BCA
Semester: Second
Course: Visual Programming Lab
Course Code: 3CP.155

L	T	P	C
0	0	2	1

Course Objective:

- Design, create, build, and debug Visual Basic applications.
- Explore Visual Basic's Integrated Development Environment (IDE).
- Implement syntax rules, variable, data types and arithmetic operations in Visual Basic programs.
- Write and apply decision structures for determining different operations.
- Write and apply loop structures to perform repetitive tasks.
- Create one and two dimensional arrays for sorting, calculating, and displaying of data.
- Write Visual Basic programs using object-oriented programming techniques including classes, objects, methods, instance variables, composition, and inheritance, and polymorphism.
- Write Windows applications using forms, controls, and events

Program:

1. Program to accept a character from console and check the case of the character.
2. Program to accept any character from keyboard and display whether it isVowel or not.
3. Program to implement a calculator.
4. Program to input a number and check whether the number is Armstrong or not.
5. Program to find prime number between range of start number and end number.
6. To display Fibonacci series up to nth term
7. Program to print the multiplication table from 2 to 10
8. Design a digital watch using timer control.
9. Develop a VB.Net application to perform timer based quiz of 10 questions.
10. Program to find the greatest among two numbers.
11. Program to determine whether a person is eligible to vote or not.
12. Develop a program to illustrate picture box and image list box
13. Program to Illustrate color dialog, font dialog, and open file dialog
14. Develop a menu based VB.Net application to implement a text editor with cut, copy, paste, save and close operations.
15. Program to read and print the details of a student using class and objects
16. Program to implement the concept of MDI form
17. Program to find the sum of digits of a number. Use the concept of function for it.
18. To sort the elements of an array.
19. Program to add controls during runtime
20. Program to implement the concept of constructor

Program: BCA
Semester: Second
Course: Computer Architecture
Course Code: 3C.152

L	T	P	C
4	0	0	4

Course Objective:

- Understand the basic components of a computer, including CPU, memories, and input/output, and their organization.
- Understand the cost performance tradeoff in designing memory hierarchy and instruction sets.
- Understand and be able to use assembly languages for solving simple problems. Understand the relationship between high level language and assembly language.
- Be able to follow the trends in computer design and appreciate the design philosophy behind.

Unit I:

Basic Computer Organizations and Design: Instruction Codes, Computer Registers, Computer Instructions, Timing and Control.

Unit II:

Basic Computer Organizations and Design: Instruction Cycle, Memory – Reference Instructions, Register reference instructions, Input -Output Instructions,Design of Accumulator Logic Shift Unit.

Central Processing Unit: Introduction, General Register Organization, Stack Organization, Instruction Formats, Addressing Modes.

Unit III:

Computer Arithmetic: Introduction, Multiplication Algorithms, Division Algorithms, for fixed Point-members. Input - Output Organization: Peripheral Devices, Input-Output Interfaces, Asynchronous Data Transfer, Modes of Transfer, Priority Interrupt, Direct Memory Access (DMA).

Unit IV:

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory, Memory Management Hardware.

Suggested Readings:

1. Morris Mano, Computer System Architecture, 3rd Edition, Prentice -Hall of India Private Limited, 1999.
2. WIliam Stallings, Computer Organization and Architecture, 4th Edition, Prentice Hall of India Private Limited, 2001
3. Harry & Jordan, Comput er Systems Design & Architecture, Addison Wesley, Delhi, 2000.
4. Malvino, “Digital Computer Electronics: An Introduction to Microcomputers”, McGraw Hill, 1993.

Program: BCA
Semester: Second
Course: Discrete Mathematics
Course Code: 3C.182

L	T	P	C
4	0	0	4

Course Objective:

- Simplify and evaluate algebraic expressions, logic circuits and use Boolean algebra to design.
- Form and solve linear equations in one variable, graph linear equations in two variables
- Form and Solve nonlinear equations using analytic methods.
- Use mathematics concepts in real world situations.
- Apply the principles of Vector algebra to solve a variety of basic problems in engineering and Applied Science
- Solve the problem related to Graph Theory.

Unit I:

Sets: Sets, Subsets, Equal Sets Universal Sets, Finite and Infinite Sets, Operation on Sets, Union, Intersection and Complements of Sets, Cartesian Product, Cardinality of Set, Simple Applications.

Unit II:

Relations And Functions: Properties of Relations, Equivalence Relation, Partial Order Relation Function: Domain and Range, Onto, Into and One to One Functions, Composite and Inverse Functions.

Unit III:

Partial Order Relations And Lattices: Partial Order Sets, Representation of POSETS using Hasse diagram, Chains. Mathematical Logic: Truth Tables, logical Connectives, Basic logical operations, Conjunction, Disjunction and Negation, Logical Connectives.

Unit IV:

Graphs: Introduction to graphs, graphs terminology and representation, path, cycle and connectivity, subgraphs, types of graphs, connected and disconnected graphs, Introduction of Trees, spanning tree, Kruskal's Algorithm for minimal spanning tree, Matrix representation of graph, Incidence and adjacency matrix.

Suggested Readings:

1. Kolman, Busby and Ross, "Discrete Mathematical Structure", PHI, 1996.
2. H.K. Dass, "Advanced Engineering Mathematics"; S.Chand & Co., 9th Revised Ed.,2001.
3. S.K. Sarkar, "Discrete Math's"; S. Chand & Co., 2000

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Program: BCA
Semester: Second
Course: Life Skills 2
Course Code: 40B.151

L	T	P	C
2	0	0	2

Course Objective: To impart basic skills of Professional Communication in English through intensive practice to the students, so as to enable them to function confidently & effectively in that Language in the Professional Sphere of their life.

The student must have some basic command of English so that the Student must be able to:

- *At the end of the course the student should become a good communicator not only in the organization but in day today life also. Should know and learn the dynamics of external and internal communication.*
- *Use some 2000 (at least 1500) general-purpose words of English to express himself/herself in writing & 1500 such words to talk about day-to-day events & experiences of life.*
- *Understand slowly-delivered spoken material in Standard Indian English, and*
- *Speak reasonably clearly (if not fluently) on routine matters with his fellow Students, with proper word stress, intonation pattern, accent and perfect articulation.*
- *Should have command over the language.*

WRITING SKILLS

Unit I: Letter Writing

- Business/official Letters
- Letter Writing Skills
- Planning of the Letter
- Letter Writing Process
- Form & Structure
- Essentials of Letter Writing
- Types of Professional Letters: letter of enquiry, letter of placing order, information seeking letter, letter of claim & complaint, information giving letter, letter of acceptance, letter of rejection

UNIT II: Professional Writing

- Job Application, introduction, layout & format (specimen)
- D O letter
- Resume & Job Application
- Covering Letter
- Editorial Letter
- Writing Mails & SMS (E-Language)
- Notice, Memo, Circular & Minutes Writing.
- Social Letters (letters to friends/relatives etc.)

STUDY SKILLS

UNIT III: Reading Skills

- Newspaper Reading

- Mechanics of Note making
- Note Making Techniques/ Reduction Devices
- Organization Techniques/Method of Sequencing
- Mechanics of Summarizing
- Outlining & Paraphrasing

UNIT IV: Referencing Skills

- Referencing Skills
- Method of Referencing
- Using Foot Notes
- Scanning and Skimming Skills
- Finding required Information/Meaning/ Pronunciation

Suggested Books & Readings:

- Monippally, Matthukutty. M. 2001. *Business Communication Strategies*. 11th Reprint. Tata McGraw-Hill. New Delhi
- Swets, Paul. W. 1983. *The Art of Talking So That People Will Listen: Getting Through to Family, Friends and Business Associates*. Prentice Hall Press. New York
- Lewis, Norman. 1991. *Word Power Made Easy.* Pocket Books
- Sen , Leena .Communication Skills ; Eastern Economy Edition
- Ghanekar , Dr. Anjali . Essentials of Business Communication Skills ; Everest Publishing House
- David Green . *Contemporary English Grammar, Structure & Composition* ; MacMillan
- Dictionary; Oxford
- Dictionary ; Longman

Websites

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- www.dictionary.cambridge.org
- www.wordsmith.org
- www.edufind.com
- www.english_the_easy_eay.com
- www.englishclub.com
- www.english_grammar_lessons.com
- www.wikipedia.org/wiki/english_grammar