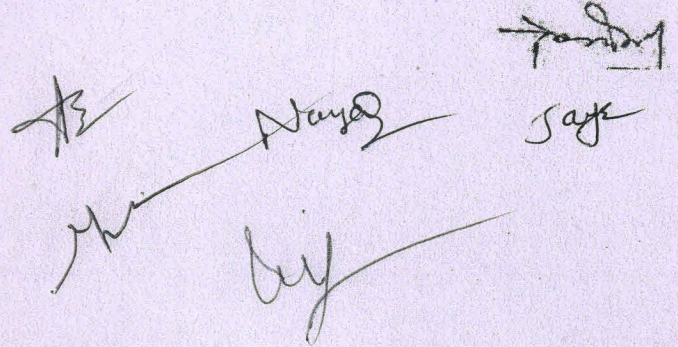


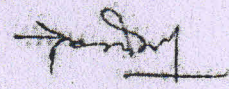
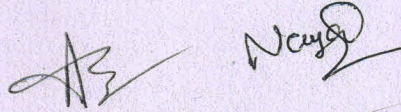
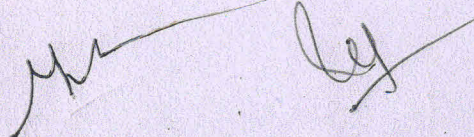
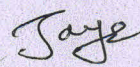
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PART A: Introduction			
Program: Certificate		Class: B.C.A.	Year: I Year
Session: 2021-22			
1.	Course Code	SI - BCAB2T	
2.	Course Title	Operating System	
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational)	Minor	
4.	Pre-Requisite (if any)	Open for all	
5.	Course Learning Outcomes (CLO)	<ul style="list-style-type: none"> • After the completion of this course, a student shall be able to do the following: • Describe the importance of computer system resources and the role of operating system in their management policies and algorithms. • Specify objectives of modern operating systems and describe how operating systems have evolved over time. • Understand various process management concepts and can compare various scheduling techniques, synchronization, and deadlocks. • Describe the concepts of memory management techniques. • Identify the best suited process management technique for any process. • Describe various file operations, file allocation methods and disk space management. • To understand and identify potential threats to operating systems and the security features to guard against them. • Learn to operate the Linux system, 	
6.	Credit Value	Theory - 4 Credits Practical - 2 Credits	
7.	Total Marks	Max. Marks : 25+75	Min. Passing Marks: 33

PART B: Content of the Course		
No. of Lectures (in hours per week): 2 Hours per week		
Total No. of Lectures: 60 Hrs.		
Module	Topics	No. of Lectures
I	Introduction to Operating System: What is Operating System? History and Evolution of OS, Basic OS functions, Resource Abstraction, Types of Operating Systems- Batch Systems, Multiprogramming Systems, Multiprocessing Systems, Time Sharing Systems, Distributed OS, Real time systems. Operating System for Personal Computers, Workstations and Hand-held Devices. Applications of various operating system in real world. Some prevalent operating systems - Windows, UNIX/Linux, Android, MacOS, Blackberry OS, Symbian, Bada etc.	6
II	Process Management: Process Concepts, Process states & Process Control Block. Process Scheduling: Scheduling Criteria, Scheduling Algorithms (Preemptive & Non- Preemptive) - FCFS, SJF, SRTN, RR, Priority,	14



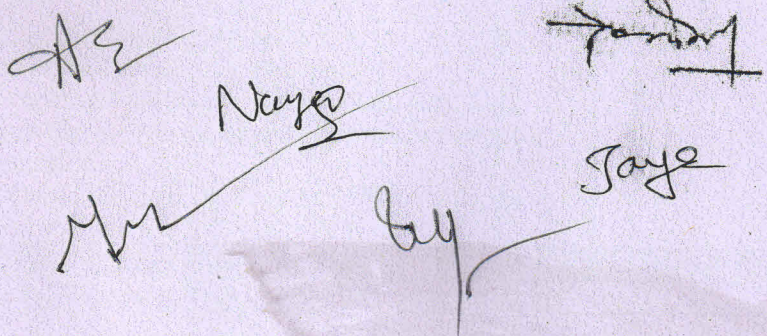
	<p>Multiple-Processor, Real-Time, Multilevel Queue and Multilevel Feedback Queue Scheduling.</p> <p>Deadlock - Definition, Deadlock Characterization, Necessary and Sufficient Conditions for Deadlock.</p> <p>Deadlock Handling Approaches: Prevention, Avoidance, Detection and Recovery.</p>	
III	<p>Memory Management: Introduction, Address Binding, Logical versus Physical Address Space, Swapping, Contiguous & Non-Contiguous Allocation, Fragmentation (Internal & External), Compaction, Paging, Segmentation, Virtual Memory, Demand Paging, Performance of Demand Paging, Page Replacement Algorithms.</p> <p>File Management: Concept of File System (File Attributes, Operations, Types), Functions of File System, Types of File System, Access Methods (Sequential, Direct & other methods), Directory Structure (Single-Level, Two-Level, Tree-Structured, Acyclic-Graph, General Graph), Allocation Methods (Contiguous, Linked, Indexed)</p>	14
IV	<p>Disk Management: Structure, Disk Scheduling Algorithms (FCFS, SSTF, SCAN, C-SCAN, LOOK), Swap Space Management, Disk Reliability, Recovery.</p> <p>Security: Security Threats, Security policy mechanism, Protection, Trusted Systems, Authentication and Internal Access Authorization, Windows Security.</p>	12
V	<p>LINUX: Introduction, History and features of Linux, advantages, hardware requirements for installation, Linux architecture, file system of Linux - boot block, super block, inode table, data blocks.</p> <p>Linux standard directories, Linux kernel, Partitioning the hard drive for Linux, installing the Linux system, system - startup and shut-down process, init and run levels. Process, Swap, Partition, fdisk, checking disk free spaces. Difference between CLI OS & GUI OS, Windows v/s Linux, Importance of Linux Kernel, Files and Directories. Concept of Open Source Software.</p>	12
VI	<p>Indian contribution to the field – the BOSS operating system, open source softwares, growth of LINUX, Aryabhata Linux, contributions of innovators – RajenSheth, Sunder Pichai etc.</p>	2
PART C: Learning Resources		
Textbooks, Reference Books, Other Resources		
Suggested Readings		
<p>Textbooks:</p> <ul style="list-style-type: none"> • A Silberschatz, P.B. Galvin, G. Gagne, Operating Systems Concepts, 8th Edition, John Wiley Publications. • A.S. Tanenbaum, Modern Operating Systems, 3rd Edition, Pearson Education. • Operating System by Peterson • Linux by Sumitabh Das • मध्यप्रदेश हिंदी ग्रंथ अकादमी से प्रकाशित विषय से संबंधित पुस्तकें। <p>Reference Books:</p> <ul style="list-style-type: none"> • G. Nutt, Operating Systems: A Modern Perspective, 2nd Edition Pearson Education. • W. Stallings, Operating Systems, Internals & Design Principles, 8th Edition, Pearson Education. • M. Milenkovic, Operating Systems- Concepts and design, Tata McGraw Hill. • Operating System design and Concepts by Milan Milenkovic. 		

Suggestive digital platform web links
https://web.iitd.ac.in/~minati/MTL458.html
https://www.cse.iitb.ac.in/~mythili/os/
https://www.youtube.com/watch?v=aCJ3YgoolHQ
Suggested equivalent online courses
https://nptel.ac.in/courses/106/102/106102132/

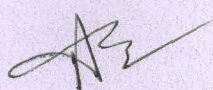
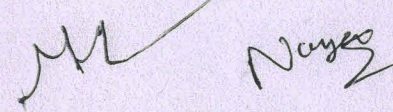

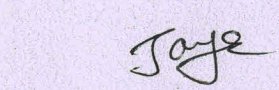
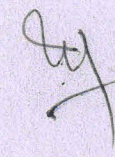
PART D: Assessment and Evaluation

Internal Assessment : Continuous Comprehensive Evaluation (CCE) : 25 Marks Shall be based on allotted assignments and Class Tests. The marks shall be as follows:		External Assessment: University Exam (UE) : 75 Marks Time : 02.00 Hours	
Assessment and presentation of assignment	4 Marks	Section (A) : Three Very Short Questions (50 Words Each) OR Nine MCQ Questions	03 x 03 = 09 Marks OR 09 x 01 = 9 Marks
Class Test I (Objective Questions)	5 Marks		Section (B) : Four Short Questions (200 Words Each)
Class Test II (Descriptive Questions)	8 Marks	Section (C): Two Long Questions (500 Words Each)	02 x 15 = 30 Marks
Class Test III (Based on OS commands)	8 Marks	Total	75 Marks
Total		Total	
Any remarks/suggestions:			



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PART A: Introduction			
Program: Certificate	Class: B.C.A.	Year: 1 Year	Session: 2021-22
1.	Course Code	SI-BCAB2P	
2.	Course Title	Operating System Lab	
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational)	Minor	
4.	Pre-Requisite (if any)	Open for All	
5.	Course Learning Outcomes (CLO)	After the completion of this course, a student shall be able to: <ul style="list-style-type: none"> • Operate the Linux system. • Do administration. • Use Vi Editor 	
6.	Credit Value	Practical – 2 Credits	
7.	Total Marks	Max. Marks : 25+75	Min. Passing Marks: 33
PART B: Content of the Course			
No. of Lab. Practicals (in hours per week): 1Hr. per week			
Total No. of Lab.: 30 Hrs.			
	Suggestive List of Practicals		No. of Labs.
	Linux: a) Linux Directory Commands: pwd, mkdir, rm -rf, ls, cd, cd /, cd ~ b) Linux File Commands: touch, cat, cat >, cat >>, rm, cp, mv, rename c) Linux Permission Commands: su, id, useradd, passwd, groupadd, chmod, groupdel, chown, chgrp d) Linux File Content & Filter Commands: head, tail, tac, more, less, grep, cat, cut, grep, comm, sed, tee, tr, uniq, wc, od, sort, diff. e) Linux Utility Commands: find, bc, locate, date, cal, sleep, time, df, mount, exit, clear, gzip, gunzip. f) Linux Networking Commands: ip, ssh, mail, ping, host g) Edit Crontab file: to wall message on system on particular time automatically. h) Vi editor: Create file, edit, save and quit. Highlighting the searched term within a file. cut, yank, undo.		30
PART C: Learning Resources			
Textbooks, Reference Books, Other Resources			
Suggested Readings			
Textbooks:			
<ul style="list-style-type: none"> • Linux by Sumitabh Das • Linux Bible • मध्यप्रदेश हिंदी ग्रंथ अकादमी से प्रकाशित विषय से संबंधित पुस्तकें। 			
Suggestive digital platform web links			
https://web.iitd.ac.in/~minati/MTL458.html https://www.cse.iitb.ac.in/~mythili/os/ https://www.youtube.com/watch?v=aCJ3YgoolHQ			

Suggested equivalent online courses			
https://nptel.ac.in/courses/106/102/106102132/			
https://www.youtube.com/watch?v=OHCmfSNpqCc			
PART D: Assessment and Evaluation			
Internal Assessment : Continuous Comprehensive Evaluation (CCE) : 25 Marks		External Assessment: University Exam (UE) : 75 Marks Time : 02.00 Hours	
Internal Assessment	Marks	External Assessment	Marks
Hands-on Lab Practice	5 Marks	Practical record file	10 Marks
Viva	5 Marks	Viva voce practical	15 Marks
Lab Test from practical list	7 Marks	Table works/ Exercise Assigned (02) in practical exam	40 Marks
Assignments (Charts/ Model)/ Technology Dissemination/ Excursion/ Lab visit/ Industrial Training	8 Marks	Reports of excursion/ Lab visits/ Industrial training/ Survey/ Collection/ Models	10 Marks
Total	25 Marks	Total	75 Marks
<i>Excursion/ Lab visits/ Industrial Training is compulsory</i>			

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Part A Introduction			
Program:Certificate Course		Class:BCAI Year	Year: 2021 Session: 2021-2022
1	Course Code	SI-BCAC2G	
2	Course Title	Discrete Mathematics	
3	Course Type	Elective	
4	Pre-requisite (if any)	Open for All	
5	Course Learning Outcomes (CLO)	The course will enable the students: 1. Apply the Boolean algebra, switching circuits and their applications. 2. Minimize the Boolean Function using Karnaugh Map. 3. Understand the lattices and their types. 4. Graphs, their types and its applications in study of shortest path algorithms. 5. Test whether two given graphs are isomorphic. 6. Understand the Eulerian and Hamiltonian graphs. 7. Represent graphs using adjacency and incidence matrices. 8. Understand the discrete numeric functions, generating functions and Recurrence Relations.	
6	Credit Value	Theory:6Credit	
7	Total Marks	Max. Marks: 25 + 75	Min. Passing Marks: 33

Part B - Content of the Course		
Total No. of Lectures (in hours per week): 3 hours per week		
Total Lectures: 90 hours		
Unit	Topics	No. of Lectures
I	Relations: Binary, Inverse, Composite and Equivalence relation, Equivalence classes and its properties, Partition of a set, Partial order relation, Partially ordered and Totally ordered sets, Hasse diagram. Lattices: Definition and examples, Dual, bounded, distributive and complemented lattices.	18
II	Boolean Algebra: Definition and properties, Switching circuits and its applications, Logic gates and circuits. Boolean functions: Disjunctive and conjunctive normal forms, Bool's expansion theorem, Minimize the Boolean function using Karnaugh Map.	18
III	Graphs: Definition and types of graphs, Subgraphs, Walk, path and circuit, Connected and disconnected graphs, Euler graph, Hamiltonian path and circuit, Dijkstra's Algorithm for shortest paths in weighted graph.	18

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IV	Trees: Definition and its properties, Rooted, Binary and Spanning tree Rank and nullity of a graph, Kruskal's and Prim's Algorithm, Cut-set and its properties, Fundamental Circuit and Cut-Set, Planar graphs. Matrix representation of graphs: Incidence, Adjacency, Circuit, Cut-Set, Path.	18
V	Discrete numeric and generating functions: Operations on numeric functions, Asymptotic behavior of numeric functions, Generating functions. Recurrence relations and recursive algorithms: Recurrence relations, Linear recurrence relations with constant coefficients, Homogeneous solutions, Particular solutions, Total solutions, Solution by the method of generating functions.	18
Keywords/Tags: Relation, Hasse diagram, Lattices, Boolean Algebra, Boolean function, Graph and Subgraph, Path and circuit, Tree, Spanning tree, Cut-set, Matrix representation of graph, Discrete numeric function, Generating function, Recurrence relation, Recursive algorithm.		

Part C - Learning Resources	
Text Books, Reference Books, Other Resources	
Suggested Readings:	
Text Books:	
1. J. P. Tremblay and R. Manohar, Discrete Mathematical Structures With Applications To Computer Science, McGraw Hill Education, 1st edition, 2017.	
2. C. L. Liu: Elements of Discrete Mathematics, McGraw Hill Education, 4th edition, 2017.	
3. Narsingh Deo: Graph Theory with Applications to Engineering and Computer Science, Prentice Hall India Learning Private Limited, 1979.	
4. मध्य प्रदेश हिन्दी ग्रंथ अकादमी से प्रकाशित विषय से संबंधित पुस्तकें।	
Reference Books:	
1. Seymour Lipschutz and Mark Lipson: Discrete Mathematics (Schaums Outline), McGraw Hill Education, 3rd edition, 2017.	
2. Edgar G. Goodaire and Michael M. Parmenter, Discrete Mathematics with Graph Theory, Pearson Education Pt.Ltd., Indian Reprint 2003.	
Suggested Digital Platforms Web links:	
https://www.highereducation.mp.gov.in/?page=xhzIQmpZwkyIQo2b%2Fy5G7w%3D%3D	
Suggested Equivalent online courses:	
https://nptel.ac.in/courses/111106086/	
https://ugcmoocs.inflibnet.ac.in/index.php/courses/view_ug/311	

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Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks: 100		
Continuous Comprehensive Evaluation (CCE): 25Marks		
University Exam (UE): 75Marks		
Internal Assessment:	Class Test	15
Continuous Comprehensive Evaluation (CCE)	Assignment/Presentation	10
		Total Marks: 25
External Assessment:	Section (A): Three Very Short Questions (50 Words Each)	03 × 03 = 09
University Exam (UE)	Section (B): Four Short Questions (200 Words Each)	04 × 09 = 36
Time: 02.00 Hours	Section (C): Two Long Questions (500 Words Each)	02 × 15 = 30
		Total Marks: 75

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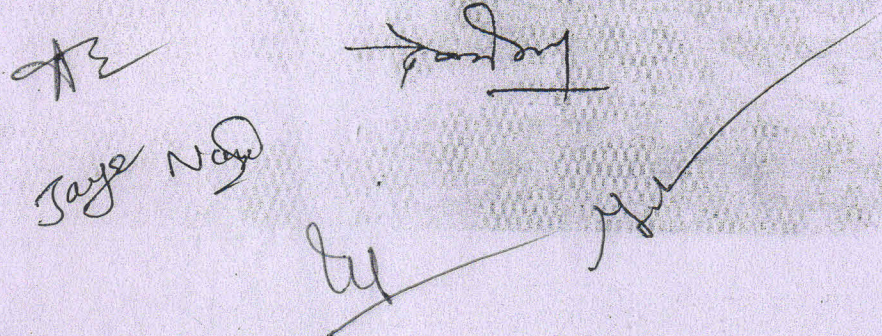
PART A: Introduction			
Program: Certificate	Class: B.C.A.	Year: I Year	Session: 2021-22
1.	Course Code	SI-BCA1T	
2.	Course Title	Computer Fundamentals, Organization and Architecture	
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational)	Major - Paper I	
4.	Pre-Requisite (if any)	To study this course, a student must have basic knowledge of Computers.	
5.	Course Learning Outcomes (CLO)	After the completion of this course, a successful student will be able to : <ul style="list-style-type: none"> • Understand the basic structure, operation and characteristics of digital computer. • Design simple combinational digital circuits based on given parameters. • Understand the working of arithmetic and logic unit. • Know about hierarchical memory system including cache memories and virtual memory. • Know the contributions of Indians in the field of computer architecture and related technologies. 	
6.	Credit Value	Theory - 4 Credits Practical - 2 Credits	
7.	Total Marks	Max. Marks : 25+75	Min. Passing Marks: 33

PART B: Content of the Course

No. of Lectures (in hours per week): 2 Hrs. per week

Total No. of Lectures: 60 Hrs.

Module	Topics	No. of Lectures
I	Fundamentals of computers: Definition, Characteristics, capabilities and limitations. Types of Computers: Analog, Digital, Micro, Mini, Mainframe & Super Computers, Work Station, Server computers. Generations of Computers. Smart Systems: definition, characteristics and applications. Definition of Embedded system, GIS, GPS, Cloud Computing. Uses of computers in e-governance and various public domains and services.	8
II	Block diagram of computer and its functional units. Concept of hardware, software and firmware. Types of software. Input devices - keyboard, scanner, mouse, light pen, bar code reader, OMR, OCR, MICR, track ball, joystick, touch screen camera, mic etc. Output devices: monitors - classification of monitors based on technology -CRT & flat panel, LCD, LED monitors, speakers, printers - dot matrix printer, ink jet printer, laser printer, 3D Printers, Wi-Fi enabled printers, plotters and their types, LCD/LED projectors.	10



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1. M.Morris Mano, "Computer System Architecture", PHI.
2. Heuring Jordan, "Computer System Design & Architecture" (A.W.L.)
3. मध्य प्रदेश हिंदी ग्रंथ अकादमी से प्रकाशित विषय से संबंधित पुस्तकें।

Reference Books:

4. William Stalling, "Computer Organization & Architecture", Pearson Education Asia.
5. V. Carl Hamacher, "Computer Organization", TMH
6. Tannenbaum, "Structured Computer Organization", PHI.
7. Er. Rajiv Chopra, "Computer Architecture", Revised 3rd Edition, S. Chand & Company Pvt. Ltd

Suggestive digital platform web links

<https://www.youtube.com/watch?v=4TzMyXmzL8M>

<https://nptel.ac.in/courses/106/106/106106166/>

<https://nptel.ac.in/courses/106/106/106106134/>

Suggested equivalent online courses

<https://nptel.ac.in/courses/106/105/106105163/>

PART D: Assessment and Evaluation

Internal Assessment : Continuous Comprehensive Evaluation (CCE) : 25 Marks Shall be based on allotted assignments and Class Tests. The marks shall be as follows:		External Assessment: University Exam (UE) : 75 Marks Time : 02.00 Hours	
Assessment and presentation of assignment	4 Marks	Section (A): Three Very Short Questions (50 Words Each)	03 x 03 = 09 Marks
Class Test I (Objective Questions)	5 Marks	OR Nine MCQ Questions	OR 09 x 01 = 09 Marks
Class Test II (Descriptive Questions)	8 Marks	Section (B) : Four Short Questions (200 Words Each)	04 x 09 = 36 Marks
Class Test III (Based on solving circuit design problems)	8 Marks	Section (C): Two Long Questions (500 Words Each)	02 x 15 = 30 Marks
Total	25 Marks	Total	75 Marks
Any remarks/suggestions:			

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PART A: Introduction			
Program: Certificate		Class: B.C.A	Year: I Year
Session: 2021-22			
1.	Course Code	SI-BCAAIP	
2.	Course Title	Computer Fundamentals and Digital Lab	
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational)	Major – Paper I	
4.	Pre-Requisite (if any)	Open for All	
5.	Course Learning Outcomes(CLO)	<p>After the completion of this course, a successful student will be able to do the following:</p> <ul style="list-style-type: none"> • Familiarity with parts of the computer and peripheral devices used with the computer. • Realization of the basic logic and universal gates. • Verify the behavior of logic gates using truth tables. • Implement Binary-to -Gray, Gray-to -Binary code conversions. • Design half and full adder circuit using basic gates. • Design and construct flip flops and verify the excitation tables. 	
6.	Credit Value	Practical - 2 Credits	
7.	Total Marks	Max.Marks: 25+75	Min. Passing Marks: 33
PART B: Content of the Course			
No. of Lab. Practicals (in hours per week): 1 Hrs. per week			
Total No. of Labs: 30 Hrs.			
	Suggestive list of Practicals		No. of Labs.
	<p>I. Computer Fundamentals</p> <p>a) Identify various parts of the computer by physical examination. b) Identify various parts inside the CPU like motherboard, SMPS, ports, buses, IC chips, Processor, HDD, RAM etc. c) Identify various I/O devices available in the lab physically.</p> <p>II. Digital Electronics</p> <p>a) Verification and interpretation of truth table for AND, OR, NOT gates b) Verification and interpretation of truth table for NAND, NOR gates c) Verification and interpretation of truth table for Ex-OR, Ex-NOR gates d) Study of half adder using XOR and NAND gates and verification of its operation e) Study of full adder using XOR and NAND gates and verification of its operation</p>		30 Hrs.

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	<p>f) Study of half subtractor and verification of its operation</p> <p>g) Study of full subtractor and verification of its operation</p> <p>h) Realization of logic functions with the help of NAND -Universal Gates</p> <p>i) Realization of logic functions with the help of NOR -Universal Gates</p> <p>j) Verify the truth table of RS flip-flops using NAND and NOR gates</p> <p>k) Verify the truth table of JK flip-flops using NAND and NOR gates</p> <p>l) Verify the truth table of T and D flip-flops using NAND and NOR gates</p> <p>m) Implementation of 4x1 multiplexer using logic gates</p> <p>n) Implementation of 1x4 demultiplexer using logic gates</p> <p>o) Verify Gray to Binary conversion using NAND gates only</p> <p>p) Verify Gray to Binary conversion using NAND gates only</p>	
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PART C: Learning Resources

Textbooks, Reference Books, Other Resources

Suggested Readings

Textbooks:

- M.Morris Mano, "Computer System Architecture", PHI.
- Heuring Jordan, "Computer System Design & Architecture" (A.W.L.)
- मध्यप्रदेश हिंदी ग्रंथ अकादमी से प्रकाशित विषय से संबंधित पुस्तकें।

Reference Books:

- William Stalling, "Computer Organization & Architecture", Pearson Education Asia.
- V. Carl Hamacher, "Computer Organization", TMH
- Tannenbaum, "Structured Computer Organization", PHI.

Suggestive digital platform web links

<https://de-iitr.vlabs.ac.in/>

Suggested equivalent online courses

<https://nptel.ac.in/courses/106/105/106105163/>

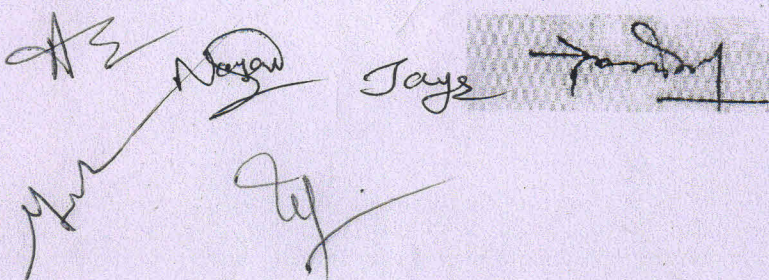
PART D: Assessment and Evaluation

Internal Assessment : Continuous Comprehensive Evaluation (CCE) : 25 Marks

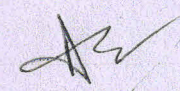
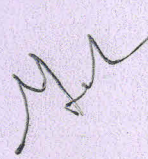
External Assessment: University Exam (UE): 75 Marks

Time : 02.00 Hours

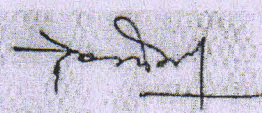

Internal Assessment	Marks	External Assessment	Marks
Hands-on Lab Practice	5 Marks	Practical record file	10 Marks
Viva	5 Marks	Viva voce practical	15 Marks
Lab Test from practical list	7 Marks	Table works/ Exercise Assigned (02) in practical exam	40 Marks



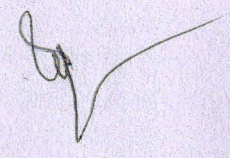
Assignments (Charts/ Model)/ Technology Dissemination/ Excursion/ Lab visit/ Industrial Training	8 Marks	Reports of excursion/ Lab visits/ Industrial training/ Survey/ Collection/ Models	10 Marks
Total	25 Marks	Total	75 Marks
<i>Excursion/ Lab visits/ Industrial Training is compulsory</i>			

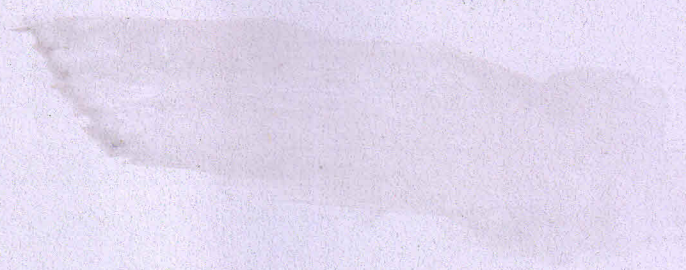



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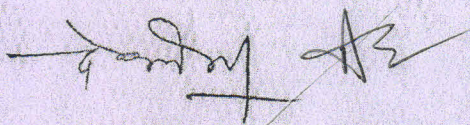
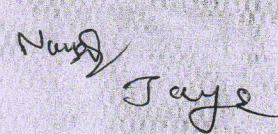



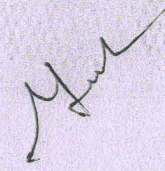
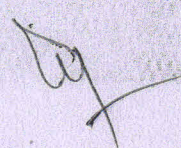
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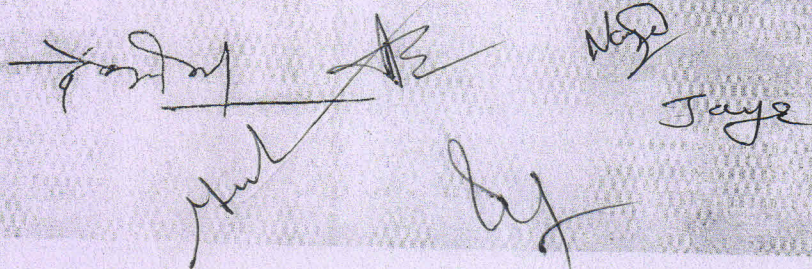


PART A: Introduction			
Program: Certificate	Class: B.C.A.	Year: I Year	Session: 2021-22
1.	Course Code	S1 - BCAA2T	
2.	Course Title	Programming Methodology & Data Structures	
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational)	Major - Paper II	
4.	Pre-Requisite (if any)	To study this course, a student must have basic knowledge of Computers.	
5.	Course Learning Outcomes(CLO)	<p>After the completion of this course, a successful student will be able to do the following:</p> <ul style="list-style-type: none"> • Develop simple algorithms and flow charts to solve a problem with programming using top down design principles. • Writing efficient and well-structured computer algorithms/programs. • Learn to formulate iterative solutions and array processing algorithms for problems. • Use recursive techniques, pointers and searching methods in programming. • Will be familiar with fundamental data structures, their implementation; become accustomed to the description of algorithms in both functional and procedural styles. • Have knowledge of complexity of basic operations like insert, delete, search on these data structures. • Possess ability to choose a data structure to suitably model any data used in computer applications. • Assess efficiency tradeoffs among different data structure implementations. • Implement and know the applications of algorithms for searching and sorting. • Know the contributions of Indians in the field of programming and data structures. 	
6.	Credit Value	Theory - 4 Credits Practical - 2 Credits	
7.	Total Marks	Max. Marks : 25+75	Min. Passing Marks: 33
PART B: Content of the Course			
No. of Lectures (in hours per week): 2 Hrs. per week			
Total No. of Lectures: 60 Hrs.			
Module	Topics		No. of Lectures
I	Introduction to Programming - Program Concept, Characteristics of Programming, Stages in Program Development, Algorithms, Notations, Design, Flowcharts, Types of Programming Methodologies.		8

	<p>Basics of C++: A Brief History of C++, Application of C++, Compiling & Linking, Tokens, Keywords, Identifiers & Constants, Basic Data Types, User-Defined Data Types, Symbolic Constant, Type Compatibility, Reference Variables, Operator in C++, Scope Resolution Operator, Member Dereferencing Operators, Memory Management Operators, Manipulators, Type Cast Operator.</p> <p>Functions In C++: The Main Function, Function Prototyping, Call by Reference Call by Address, Call by Value, Return by Reference, Inline Function, Default Arguments, Constant Arguments, Function Overloading, Function with Array.</p>	
II	<p>Classes & Objects: A Sample C++ Program with class, Defining Member Functions, Making an Outside Function Inline, Nesting of Member Functions, Private Member Functions, Arrays within a Class, Memory Allocation for Objects, Static Data Members, Static Member Functions, Array of Objects, Object as Function Arguments, Friend Functions, Virtual functions, Returning Objects, Constant member functions, Pointer to Members, Local Classes.</p> <p>Constructor & Destructor: Constructor, Parameterized Constructor, Multiple Constructors in a Class, Constructors with Default Arguments, Dynamic Initialization of Objects, Copy Constructor, Dynamic Constructor and Destructor.</p>	10
III	<p>Inheritance: Defining Derived Classes, Single Inheritance, Making a Private Member Inheritable, Multilevel Inheritance, Hierarchical Inheritance, Multiple Inheritance, Hybrid Inheritance, Virtual Base Classes, Abstract Classes, Constructor in Derived Classes, Nesting of Classes. Operator Overloading & Type Conversion, Polymorphism, Pointers, Pointers with Arrays C++, Streams, C++ Stream Classes, Unformatted I/O Operation, Formatted I/O Operation, Managing Output with Manipulators, Exception Handling.</p>	8
IV	<p>Data Structure: Basic concepts, Linear and Non-Linear data structures</p> <p>Algorithm Specification: Introduction, Recursive algorithms, Data Abstraction, Performance analysis.</p> <p>Arrays: Representation of single, two-dimensional arrays, triangular arrays, sparse matrices-array and linked representations.</p> <p>Stacks: Operations, Array and Linked Implementations, Applications-Infix to Postfix Conversion, Infix to Prefix Conversion, Postfix Expression Evaluation, Recursion Implementation.</p> <p>Queues: Definition, Operations, Array and Linked Implementations, Circular Queue-Insertion and Deletion Operations, Dequeue (Double Ended Queue), Priority Queue- Implementation.</p>	12
V	<p>Linked Lists: Singly Linked Lists, Operations, Concatenating, circularly linked lists-Operations for Circularly linked lists, Doubly Linked Lists- Operations, Doubly Circular Linked List, Header Linked List</p> <p>Trees: Representation of Trees, Binary tree, Properties of Binary Trees, Binary Tree Representations- Array and Linked Representations,</p>	10



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	Binary Tree Traversals, Threaded Binary Trees. Heap: Definition, Insertion, Deletion.	
VI	Graphs: Graph ADT, Graph Representations, Graph Traversals, Searching. Hashing: Introduction, Hash tables, Hash functions, Overflow Handling. Sorting: Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort, Comparison of Sorting Methods, Search Trees: Binary Search Trees, AVL Trees- Definition and Examples.	10
VII	Indian Contribution to the field: Innovations in India, origin of Julia Programming Language, Indian Engineers who designed new programming languages, open source languages, Dr. Sartaj Sahni – computer scientist - pioneer of data structures, Other relevant contributors and contributions.	2

PART C: Learning Resources

Textbooks, Reference Books, Other Resources

Suggested Readings

Textbooks:

- J. R. Hanly and E. B. Koffman, "Problem Solving and Program Design in C", Pearson, 2015
- E. Balguruswamy, "C++", TMH Publication ISBN 0-07-462038-X
- Herbert Schildt, "C++ The Complete Reference" TMH Publication ISBN 0-07-463880-7
- मध्य प्रदेश हिंदी ग्रंथ अकादमी से प्रकाशित विषय से संबंधित पुस्तकें।

Reference Books:

- R. Lafore, "Object Oriented Programming C++"
- N. Dale and C. Weems, "Programming and problem solving with C++: brief edition", Jones & Bartlett Learning.
- Adam Drozdek, "Data Structures and algorithm in C++", Third Edition, Cengage Learning.
- Sartaj Sahani, "Data Structures, Algorithms and Applications with C++", McGraw Hill.
- Robert L. Kruse, "Data Structures and Program Design in C++", Pearson.
- D.S. Malik, "Data Structure using C++", Second edition, Cengage Learning.
- M. A. Weiss, "Data structures and Algorithm Analysis in C", 2nd edition, Pearson.
- Lipschutz, "Schaum's outline series Data structures", Tata McGraw-Hill

Suggestive digital platform web links

<https://www.youtube.com/watch?v=BC1S40yzsA>
<https://www.youtube.com/watch?v=vLnPwxZdW4Y&v1=en>
<https://www.youtube.com/watch?v=Umm1ZQ5ltZw>

Suggested equivalent online courses

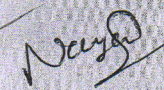
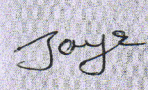
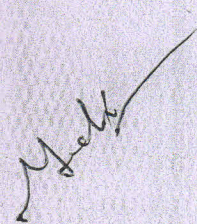
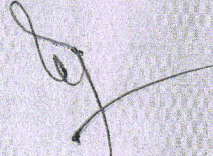
S.No.	Online Course	Duration	Platform
1	Programming in C++ https://nptel.ac.in/courses/106/105/106105151/	8 weeks	NPTEL
2	Beginning C++ Programming - From Beginner to Beyond https://www.udemy.com/course/beginning-c-plus-plus-programming/	Self paced	Udemy

PART D: Assessment and Evaluation

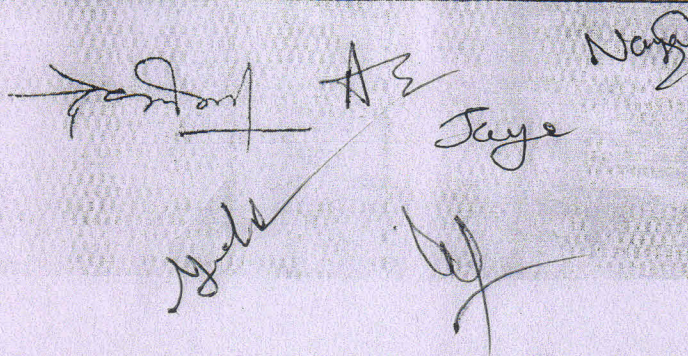
Internal Assessment : Continuous

External Assessment: University Exam (UE) : 75

Comprehensive Evaluation (CCE) : 25 Marks Shall be based on allotted assignments and Class Tests. The marks shall be as follows:		Marks Time : 02.00 Hours	
Assessment and presentation of assignment	8 Marks	Section (A) : Three Very Short Questions (50 Words Each) OR Nine MCQ Questions	03 x 03 = 09 Marks
Class Test I (Objective Questions)	4 Marks		
Class Test II (Descriptive Questions)	5 Marks	Section (B) : Four Short Questions (200 Words Each)	04 x 09 = 36 Marks
Class Test III (Based on solving programming problems)	8 Marks	Section (C): Two Long Questions (500 Words Each)	02 x 15 = 30 Marks
Total	25 Marks	Total	75 Marks
Any remarks/suggestions: Focus of the course/teaching should be on developing ability of the student in analyzing a problem, building the logic and efficient code for the problem.			

PART A: Introduction			
Program: Certificate		Class: B.C.A.	Year: I Year
		Session: 2021-22	
1.	Course Code	SI-BCAA2P	
2.	Course Title	Programming Methodology & Data Structures Lab	
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational)	Major – Paper II	
4.	Pre-Requisite (if any)	To study this course, a student must have basic knowledge of Computers.	
5.	Course Learning Outcomes(CLO)	<p>After the completion of this course, a successful student will be able to do the following:</p> <ol style="list-style-type: none"> 1. Develop simple algorithms and flow charts to solve a problem with programming using top down design principles. 2. Writing efficient and well-structured computer algorithms/programs. 3. Learn to formulate iterative solutions and array processing algorithms for problems. 4. Use recursive techniques, pointers and searching methods in programming. 5. Possess ability to choose a data structure to suitably model any data used in computer applications. 6. Implement and know the applications of algorithms for searching and sorting etc. 	
6.	Credit Value	Practical – 2 Credits	
7.	Total Marks	Max. Marks : 25+75	Min. Passing Marks: 33
PART B: Content of the Course			
No. of Lab Practicals (in hours per week): 1 hour per week			
Total No. of Lab.: 30 Hrs.			
	Suggestive list of Practicals		No. of Labs.
	<p>Given the problem statement, students are required to formulate problem, develop flowchart/algorithm, write code in C++, execute and test it. Students should be given assignments on following :</p> <ol style="list-style-type: none"> 1. Write a program to swap the contents of two variables. 2. Write a program for finding the roots of a Quadratic Equation. 3. Write a program to find area of a circle, rectangle, square using switch case. 4. Write a program to print table of any number. 5. Write a program to print Fibonacci series. 6. Write a program to find factorial of a given number using recursion. 7. Write a program to convert decimal (integer) number into 		30



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equivalent binary number.

8. Write a program to check given string is palindrome or not.
9. Write a program to print digits of entered number in reverse order.
10. Write a program to print sum of two matrices.
11. Write a program to print multiplication of two matrices.
12. Write a program to generate even/odd series from 1 to 100.
13. Write a program whether a given number is prime or not.
14. Write a program for call by value and call by reference.
15. Write a program to create a pyramid structure
1
12
123
1234
16. Write a program to check entered number is Armstrong or not.
17. Write a program to input N numbers and find their average.
18. Write a program to find the area and volume of a rectangular box using constructor.
19. Write a program to design a class time with hours, minutes and seconds as data members. Use a data function to perform the addition of two time objects in hours, minutes and seconds.
20. Write a program to implement single inheritance.
21. Write a program to find largest element from an array.
22. Write a program to implement push and pop operations on a stack using array.
23. Write a program to perform insert and delete operations on a queue using array.
24. Write a program for Linear search.
25. Write a program for Binary search.
26. Write a program for Bubble sort.
27. Write a program for Selection sort.
28. Write a program for Quick sort.
29. Write a program for Insertion sort.
30. Write a program to implement linked list.

PART C: Learning Resources

Textbooks, Reference Books, Other Resources

Suggested Readings

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Learning.

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- Lipschutz, "Schaum's outline series Data structures", Tata McGraw-Hill

Suggestive digital platform web links

<https://www.youtube.com/watch?v=BCIS40yzsA>

<https://www.youtube.com/watch?v=vLnPwxZdW4Y&vl=en>

<https://www.youtube.com/watch?v=Umm1ZQ5ltZw>

Suggested equivalent online courses

S.No.	Online Course	Duration	Platform
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2	Beginning C++ Programming - From Beginner to Beyond https://www.udemy.com/course/beginning-c-plus-plus-programming/	Self paced	Udemy

PART D: Assessment and Evaluation

Internal Assessment : Continuous Comprehensive Evaluation (CCE) : 25 Marks		External Assessment: University Exam (UE) : 75 Marks Time : 02.00 Hours	
Internal Assessment	Marks	External Assessment	Marks
Hands-on Lab Practice	5 Marks	Practical record file	10 Marks
Viva	5 Marks	Viva voce practical	15 Marks
Lab Test from practical list	7 Marks	Table works/ Exercise Assigned (02) in practical exam	40 Marks
Assignments (Charts/ Model/ Technology Dissemination/ Excursion/ Lab visit/ Industrial Training	8 Marks	Reports of excursion/ Lab visits/ Industrial training/ Survey/ Collection/ Models	10 Marks
Total <i>Excursion/ Lab visits/ Industrial Training is compulsory</i>	25 Marks	Total	75 Marks

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