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**PART A: Introduction**

Program: <b>Certificate</b>	Class: <b>B.Sc.</b>	Year: <b>I Year</b>	Session: <b>2021-22</b>
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Subject: **Computer Science**

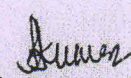
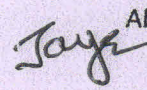
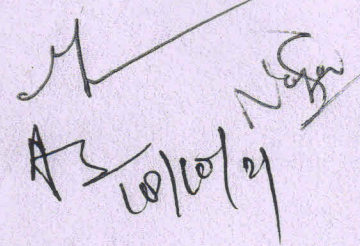
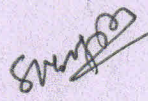

1.	Course Code	<b>S1-COSC 11</b>
2.	Course Title	<b>Computer System Architecture (Paper 1)</b>
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational)	<b>Core Course</b>
4.	Pre-Requisite (if any)	To study this course, a student must have had the subject Physics/Maths in 12 <sup>th</sup> class.
5.	Course Learning Outcomes(CLO)	<p><b>On completion of this course, learners will be able to:</b></p> <ol style="list-style-type: none"> <li>1. Understand the basic structure, operation and characteristics of digital computer.</li> <li>2. Be able to design simple combinational digital circuits based on given parameters.</li> <li>3. Familiarity with working of arithmetic and logic unit as well as the concept of pipelining.</li> <li>4. Know about hierarchical memory system including cache memories and virtual memory.</li> <li>5. Understand concept and advantages of parallelism, threading, multiprocessors and multicore processors.</li> <li>6. Know the contributions of Indians in the field of computer architecture and related technologies.</li> </ol>
6.	Credit Value	<b>Theory – 4 Credits</b>
7.	Total Marks	Max. Marks : <b>25+75</b> Min. Passing Marks: <b>33</b>

**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
1	<p><b>Fundamentals of Digital Electronics:</b> Data Types, Complements, Fixed-Point Representation. Floating-Point Representation, Binary and other Codes, Error Detection Codes.</p> <p><b>Logic Gates,</b> Boolean Algebra, Map Simplification, Combinational Circuits, Sequential Circuits, simple combinational circuit design problems.</p> <p><b>Circuits-</b> Adder- Subtractor, Multiplexer, Demultiplexer, Decoders, Encoders Flip - Flops, Registers, Counters.</p>	10

  
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II	<b>Basic Computer Organization:</b> Instruction codes, Computer Registers, Computer Instructions, Timing & Control, Instruction Cycles, Memory Reference Instruction, Input - Output & Interrupts, Complete Computer Description & Design of Basic Computer.	10
III	<b>Instructions</b> - Instruction formats, Addressing modes, Instruction codes, Machine language, Assembly language. <b>Register Transfer and Micro operations</b> - Register Transfer Language, Register Transfer, Bus & Memory Transfer, Arithmetic Micro-operations, Logic Micro-operations, Shift Micro-operations.	10
IV	<b>Processor and Control Unit</b> - Hardwired vs. Micro programmed Control Unit, General Register Organization, Stack Organization, Instruction Format, Data Transfer & Manipulation, Program Control, Introductory concept of RISC, CISC, advantages and disadvantages of both. <b>Pipelining</b> – concept of pipelining, introduction to Pipelined data path and control – Handling Data hazards & Control hazards.	10
V	<b>Memory and I/O Systems</b> - Peripheral Devices, I/O Interface, <b>Data Transfer Schemes</b> - Program Control, Interrupt, DMA Transfer. I/O Processor. <b>Memory Hierarchy</b> , Processor vs. Memory Speed, High-Speed Memories, Main memory, Auxiliary memory, Cache Memory, Associative Memory, Interleaving, Virtual Memory, Memory Management.	10
VI	<b>Parallelism</b> – meaning, types of parallelism, introduction to Instruction-level-parallelism, Parallel processing challenges, Applications. <b>Flynn's classification</b> – Introduction to SISD, SIMD, MISD, MIMD <b>Hardware multithreading</b> – Introduction, types, advantages and applications. <b>Multicore processors</b> – Introduction, advantages, difference from multiprocessor.	8
VII	<b>Indian contribution to the field</b> – Contributions of reputed scientists of Indian origin - like - Dr. Vinod Dham – Father of Intel Pentium Processor, Dr. Ajay Bhat – Co-Inventor of USB Technology, Dr. Vinod Khosla- co-founder of Sun Microsystems, Dr. Vijay P Bhatkar - architect of India's national initiative in supercomputing, and many others. <b>Parallel Computing projects of India</b> – PARAM, ANUPAM, FLOSOLVER, CHIPPS etc. Other relevant contributors and contributions.	2

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**Keywords/Tags:** Digital Electronics, Logic Gates, Circuits, Instruction formats, Addressing Modes, Parallelism, Pipelining, Memory Hierarchy, Multicore, Multithreading, SISD, SIMD, MISD, MIMD, PARAM, ANUPAM, FLOSOLVER, CHIPPS

**PART C: Learning Resources**

**Textbooks, Reference Books, Other Resources**

**Suggested Readings:**

- M.Morris Mano, "Computer System Architecture", PHI.
- Heuring Jordan, "Computer System Design & Architecture" (A.W.L.)
- 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://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**


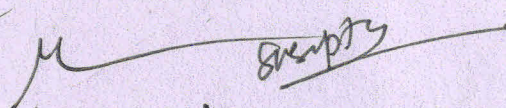
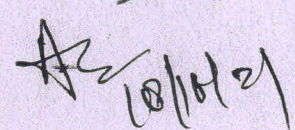
Assessment and presentation of assignment	10 Marks	Section (A) : Three Very Short Questions (50 Words Each )	03 x 03 = 09 Marks
Class Test I ( Objective Questions)	5 Marks	OR Nine MCQ Questions	09 x 01 = 09 Marks
Class Test II (Descriptive Questions)	5 Marks	Section (B) : Four Short Questions (200 Words Each)	04 x 09 = 36 Marks
Class Test III ( Based on solving circuit design problems)	5 Marks	Section (C): Two Long Questions (500 Words Each)	02 x 15 = 30 Marks
<b>Total</b>	<b>25 Marks</b>	<b>Total</b>	<b>75 Marks</b>

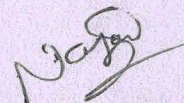
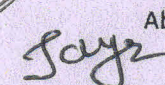
**Any remarks/suggestions:** Learnings in the course should be emphasised more on practical aspects and real world problems and their solutions.

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PART A: Introduction			
Program: Certificate		Class: B.Sc.	Year: I Year
Session: 2021-22			
Subject: Computer Science			
1.	Course Code	SI-COSC.IP	
2.	Course Title	Computer Architecture Lab ( Paper I )	
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational)	Core Course	
4.	Pre-Requisite (if any)	To study this course, a student must have had the subject Physics/Maths in 12 <sup>th</sup> class.	
5.	Course Learning Outcomes(CLO)	<b>On completion of this course, learners will be able to:</b> <ol style="list-style-type: none"> <li>1. Realization of the basic logic and universal gates.</li> <li>2. Verify the behavior of logic gates using truth tables.</li> <li>3. Implement Binary-to -Gray, Gray-to -Binary code conversions</li> <li>4. Design half and full adder circuit using basic gates.</li> <li>5. Design and construct flip flops and verify the excitation tables.</li> </ol>	
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): 2 Hrs. per week			
Total No. of Labs: ( 30 Hrs )			
Suggestive list of Practicals			No. of Labs.
<ol style="list-style-type: none"> <li>1. To study basic gates (AND, OR, NOT) and verify their truth tables.</li> <li>2. To convert a given binary number to Gray code using IC 7486.</li> <li>3. To study and verify NAND as Universal gate using IC 7400.</li> <li>4. To study half adder using basic gates and verify its truth table.</li> <li>5. To study Full Adder using basic gates and verify its truth table.</li> <li>6. To realize basic gates (AND, OR, NOT) from Universal gates (NAND and NOR).</li> <li>7. To verify truth table of 4-bit adder using IC 7483.</li> <li>8. To design and construct RS flip Flop using gates and verify the truth table.</li> <li>9. To design and construct JK flip Flop using gates and verify the truth table.</li> <li>10. To verify DeMorgan's Theorem.*</li> </ol>			


  
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**Keywords/Tags:** Digital Electronics, Logic Gates, AND, OR, NOT, IC 7486, IC 7400, NAND, NOR, IC 7483, Circuits, Flip Flop, DeMorgan's Theorem

**PART C: Learning Resources**

**Textbooks, Reference Books, Other Resources**

**Suggested Readings:**

- M.Morris Mano, "Computer System Architecture", PHI.
- Heuring Jordan, "Computer System Design & Architecture" (A.W.L.)
- William Stalling, "Computer Organization & Architecture", Pearson Education Asia.
- V. Carl Hamacher, "Computer Organization", TMH
- Tannenbaum, "Structured Computer Organization", PHI.

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<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

**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
Lab Test from practical list & internal viva	12 Marks	Viva voce on practical	15 Marks
Assignments (Charts/ Model/ Seminar / Rural Service/ Technology Dissemination/ Report of Excursion/ Lab Visits/ Survey / Industrial visit)	8 Marks	Table works/ Experiments	50 Marks
<b>Total</b>	<b>25 Marks</b>	<b>Total</b>	<b>75 Marks</b>

**Any remarks/suggestions:** Learnings in the course should be emphasised more on real world problems and their solutions.

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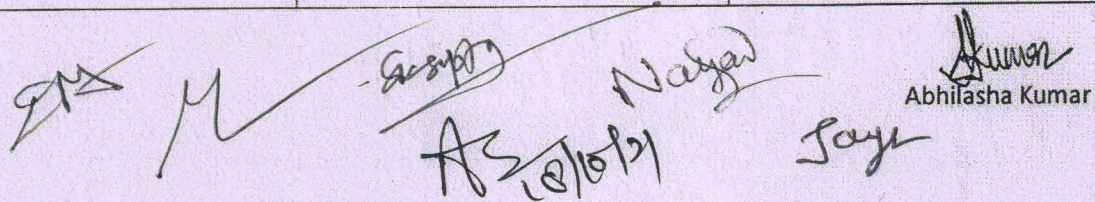
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PART A: Introduction			
Program: Certificate		Class: B.Sc.	Year: I Year
Session: 2021-22			
Subject: Computer Science			
1.	Course Code	SI-COSC2I	
2.	Course Title	Programming Methodologies & Data Structures (Paper 2)	
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational)	Core Course	
4.	Pre-Requisite (if any)	To study this course, a student must have had the subject Physics/Maths in 12 <sup>th</sup> class.	
5.	Course Learning Outcomes(CLO)	<p><b>On completion of this course, learners will be able to:</b></p> <ol style="list-style-type: none"> <li>1. Develop simple algorithms and flow charts to solve a problem with programming using top down design principles.</li> <li>2. Writing efficient and well-structured computer algorithms/programs.</li> <li>3. Learn to formulate iterative solutions and array processing algorithms for problems.</li> <li>4. Use recursive techniques, pointers and searching methods in programming.</li> <li>5. Will be familiar with fundamental data structures , their implementation; become accustomed to the description of algorithms in both functional and procedural styles</li> <li>6. Have knowledge of complexity of basic operations like insert, delete, search on these data structures.</li> <li>7. Possess ability to choose a data structure to suitably model any data used in computer applications.</li> <li>8. Design programs using various data structures including hash tables, Binary and general search trees, heaps, graphs etc.</li> <li>9. Assess efficiency tradeoffs among different data structure implementations.</li> <li>10. Implement and know the applications of algorithms for searching and sorting etc.</li> <li>11. Know the contributions of Indians in the field of programming and data structures.</li> </ol>	
6.	Credit Value	Theory – 4 Credits	
7.	Total Marks	Max. Marks : 25+75	Min. Passing Marks: 33


  
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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	<p><b>Introduction to Programming</b> - Program Concept, Characteristics of Programming, Stages in Program Development, Algorithms, Notations, Design, Flowcharts, Types of Programming Methodologies.</p> <p><b>Introduction to C++ Programming</b> - Basic Program Structure In C++, Data Types, Variables, Constants, Operators and Basic I/O .</p> <p><b>Variables</b> - Declaring, Defining and Initializing Variables, Scope of Variables, Using Named Constants, Keywords, Casting of Data Types, Operators (Arithmetic, Logical and Bitwise), Using Comments in programs, Character I/O (getc, getchar, putc, putchar etc.), Formatted and Console I/O (printf(), scanf(), cin, cout), Using Basic Header Files (stdio.h, iostream.h, conio.h etc.)</p> <p><b>Simple Expressions in C++</b> (including Unary Operator Expressions, Binary Operator Expressions), Understanding Operators Precedence in Expressions</p> <p><b>Conditional Statements</b> if construct, switch-case construct.</p>	8
II	<p><b>Iterative Statements</b> while, do-while, and for loops, Use of break and continue in Loops, Using Nested Statements (Conditional as well as Iterative)</p> <p><b>Functions</b> Top-Down Design, Pre-defined Functions, Programmer – defined Functions, Local Variables and Global variables, Functions with Default Arguments, Call-By-Value and Call-By-Reference Parameters, Recursion.</p> <p><b>Introduction to Arrays</b> - Declaration and Referring Arrays, Arrays in Memory, Initializing Arrays. Arrays in Functions, Multi-Dimensional Arrays.</p>	10
III	<p><b>Structures</b> - Member Accessing, Pointers to Structures, Structures and Functions, Arrays of Structures.</p> <p><b>Unions</b> - Declaration and Initialization.</p> <p><b>Strings</b> - Reading and Writing Strings, Arrays of Strings, String and Function, Strings and Structure, Standard String Library Functions.</p> <p><b>Searching Algorithms</b> - Linear Search, Binary Search.</p> <p><b>File Handling</b> - Use of files for data input and output, merging and copying files.</p>	8
IV	<p><b>Data Structure</b> - Basic concepts, Linear and Non-Linear data structures</p>	12

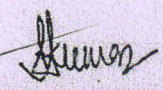
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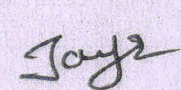
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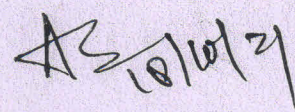
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	<p><b>Algorithm Specification</b>-Introduction, Recursive algorithms, Data Abstraction, Performance analysis.</p> <p><b>Linked List</b> - Singly Linked Lists, Operations, Concatenating, circularly linked lists-Operations for Circularly linked lists, Doubly Linked Lists- Operations.</p> <p><b>Array</b> - Representation of single, two dimensional arrays, sparse matrices-array and linked representations.</p> <p><b>Stack</b>- Operations, Array and Linked Implementations, Applications- Infix to Postfix Conversion, Postfix Expression Evaluation, Recursion Implementation.</p>	
V	<p><b>Queue</b>- Definition, Operations, Array and Linked Implementations. Circular Queue-Insertion and Deletion Operations, Dequeue (Double Ended Queue), Priority Queue- Implementation.</p> <p><b>Trees</b> - Representation of Trees, Binary tree, Properties of Binary Trees, Binary Tree Representations- Array and Linked Representations, Binary Tree Traversals, Threaded Binary Trees.</p> <p><b>Heap</b>- Definition, Insertion, Deletion.</p>	10
VI	<p><b>Graphs</b> - Graph ADT, Graph Representations, Graph Traversals, Searching.</p> <p><b>Hashing</b>- Introduction, Hash tables, Hash functions, Overflow Handling.</p> <p><b>Sorting Methods</b>, Comparison of Sorting Methods,</p> <p><b>Search Trees</b> - Binary Search Trees, AVL Trees- Definition and Examples.</p>	10
VII	<p><b>Indian Contribution to the field</b> : 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.</p>	2
<p><b>Keywords/Tags:</b> Programming, C++, Data Structures, Expressions, Control, File Handling, Arrays, Stack, Queue, Linked List, Tree, Graph, Structure, Union, Hash, Search, Sort, Algorithm</p>		
<p><b>PART C: Learning Resources</b></p>		
<p><b>Textbooks, Reference Books, Other Resources</b></p>		
<p><b>Suggested Readings:</b></p> <ul style="list-style-type: none"> <li>• Lipschutz: Schaum's outline series Data structures, Tata McGraw-Hill</li> <li>• Problem Solving and Program Design in C, J. R. Hanly and E. B. Koffman, Pearson, 2015</li> <li>• E. Balguruswamy, "C++ " TMH Publication ISBN 0-07-462038-X</li> <li>• Herbertz Shield, "C++ The Complete Reference "TMH Publication ISBN 0-07-463880-7</li> <li>• R. Lafore, 'Object Oriented Programming C++'</li> </ul>		

  
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- 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.

**Suggestive digital platform web links :**

<https://www.youtube.com/watch?v=BCIS40vzssA>

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

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

[https://www.youtube.com/watch?v=AT14ICXuMKI&list=PLdo5W4Nhv31bbKJzrsKfMpo\\_grxuL18LU](https://www.youtube.com/watch?v=AT14ICXuMKI&list=PLdo5W4Nhv31bbKJzrsKfMpo_grxuL18LU)

**Suggested equivalent online courses**

<https://nptel.ac.in/courses/106/105/106105151/>

<https://nptel.ac.in/courses/106/106/106106133/>

**PART D: Assessment and Evaluation**

<b>Internal Assessment : Continuous Comprehensive Evaluation (CCE) : 25 Marks</b> Shall be based on allotted assignments and Class Tests. The marks shall be as follows:		<b>External Assessment: University Exam (UE) : 75 Marks</b> Time : 02.00 Hours	
Assessment and presentation of assignment	10 Marks	<b>Section (A) : Three Very Short Questions (50 Words Each )</b>	03 x 03 = 09 Marks
Class Test I ( <b>Objective Questions</b> )	5 Marks	OR Nine MCQ Questions	01 x 09 = 09 Marks
Class Test II ( <b>Descriptive Questions</b> )	5 Marks	<b>Section (B) : Four Short Questions (200 Words Each)</b>	04 x 09 = 36 Marks
Class Test III ( <b>Based on solving programming problems</b> )	5 Marks	<b>Section (C): Two Long Questions (500 Words Each)</b>	02 x 15 = 30 Marks
<b>Total</b>	<b>25 Marks</b>	<b>Total</b>	<b>75 Marks</b>

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.

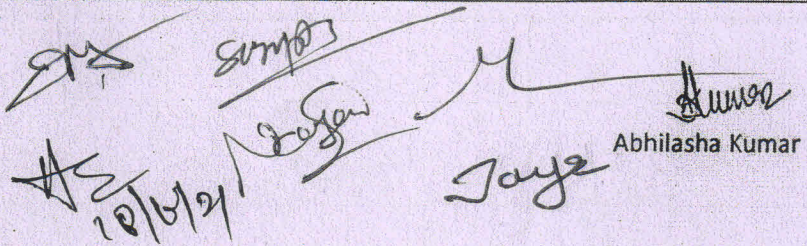
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PART A: Introduction			
Program: Certificate	Class: B.Sc.	Year: I Year	Session: 2021-22
Subject: Computer Science			
1.	Course Code	S1-COSC2P	
2.	Course Title	Office Tools & Programming Methodology Lab (Paper 2)	
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational)	Core Course	
4.	Pre-Requisite (if any)	To study this course, a student must have had the subject Physics/Maths in 12 <sup>th</sup> class.	
5.	Course Learning Outcomes(CLO)	<p><b>On completion of this course, learners will be able to:</b></p> <ol style="list-style-type: none"> <li>1. Develop simple algorithms and flow charts to solve a problem with programming using top down design principles.</li> <li>2. Writing efficient and well-structured computer algorithms/programs.</li> <li>3. Learn to formulate iterative solutions and array processing algorithms for problems.</li> <li>4. Use recursive techniques, pointers and searching methods in programming.</li> <li>5. Possess ability to choose a data structure to suitably model any data used in computer applications.</li> <li>6. Implementation of algorithms for searching and sorting.</li> </ol>	
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): 2 Hrs per week			
Total No. of Lab.: 30 Hrs			
	Suggestive list of Practicals		No. of Labs.
	<b>I. Office Tools</b>  <b>a. Using a Text Editor Tool</b> <ol style="list-style-type: none"> <li>1. Create a document and apply different Editing options.</li> <li>2. Create Banner for your college.</li> <li>3. Design a Greeting Card using Word Art for different festivals.</li> <li>4. Design your Bio data and use page borders and shading.</li> </ol>		30 Hrs.


  
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5. Create a document and insert header and footer, page title, date, time, apply various page formatting features etc.
6. Implement Mail Merge.
7. Insert a table into a document and try different formatting options for the table.

**b. Using a Spreadsheet Tool**

1. Design your class Time Table.
2. Prepare a Mark Sheet of your class result.
3. Prepare a Salary Slip of an employee of an organization.
4. Prepare a bar chart & pie chart for analysis of Election Results.
5. Prepare a generic Bill of a Super Market.
6. Work on the following exercises on a Workbook:
  - a. Copy an existing Sheet
  - b. Rename the old Sheet
  - c. Insert a new Sheet into an existing Workbook
  - d. Delete the renamed Sheet.
7. Prepare an Attendance sheet of 10 students for any 6 subjects of your syllabus. Calculate their total attendance, total percentage of attendance of each student & average of attendance.
8. Create a worksheet of Students list of any 4 faculties and perform following database functions on it.
  - a. Sort data by Name
  - b. Filter data by Class
  - c. Subtotal of no. of students by Class.

**c. Using a Presentation Tool**

1. Design a presentation of your institute using auto content wizard, design template and blank presentation.
2. Design a presentation illustrating insertion of pictures, Word Art and ClipArt.
3. Design a presentation, learn how to save it in different formats, copying and opening an existing presentation.
4. Design a presentation illustrating insertion of movie, animation and sound.
5. Illustrate use of custom animation and slide transition (using different effects).

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6. Design a presentation using charts and tables of the marks obtained in class.

II. 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 :

1. a. To learn elementary techniques involving arithmetic operators and mathematical expressions, appropriate use of selection (if, switch, conditional operators) and control structures
- b. Learn how to use functions and parameter passing in functions, writing recursive programs.
2. Write a program to swap the contents of two variables.
3. Write a program for finding the roots of a Quadratic Equation.
4. Write a program to find area of a circle, rectangle, square using switch case.
5. Write a program to check whether a given number is even or odd.
6. Write a program to print table of any number.
7. Write a program to print Fibonacci series.
8. Write a program to find factorial of a given number.
9. Write a program to convert decimal (integer) number into equivalent binary number.
10. Write a program to check given string is palindrome or not.
11. Write a program to perform multiplications of two matrices.
12. Write a program to print digits of entered number in reverse order.
13. Write a program to print sum of two matrices.
14. Write a program to print multiplication of two matrices.
15. Write a program to generate even/odd series from 1 to 100.
16. Write a program whether a given number is prime or not.
17. Write a program for call by value and call by reference.
18. Write a program to generate a series  $1+1/1!+2/2!+3/3!+\dots+n/n!$
19. Write a program to create a pyramid structure  
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20. Write a program to create a pyramid structure

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Vishal  
Nagesh  
Surya  
Jaya  
Abhilasha Kumar



1  
12  
123  
1234

21. Write a program to check entered number is Armstrong or not.
22. Write a program for traversing an Array.
23. Write a program to input N numbers, add them and find average.
24. Write a program to find largest element from an array.
25. Write a program for Linear search.
26. Write a program for Binary search.
27. Write a program for Bubble sort.
28. Write a program for Selection sort.

**Keywords/Tags:** Programming, C++, Data Structures, if, else, for, while, do, File Handling, call by value, call by reference, recursion, Arrays, Union, Hash, Linear search, Binary search, Bubble sort, Selection sort.

### PART C: Learning Resources

#### Textbooks, Reference Books, Other Resources

##### Suggested Readings:

- Problem Solving and Program Design in C, J. R. Hanly and E. B. Koffman, Pearson, 2015
- E. Balguruswamy, "C++" TMH Publication ISBN 0-07-462038-X
- Herbertz Shield, "C++ The Complete Reference" TMH Publication ISBN 0-07-463880-7
- 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=BCI340vzssA>
- <https://www.youtube.com/watch?v=vLnPwxZdW4Y&vl=en>
- <https://www.youtube.com/watch?v=Umm1ZQ5ltZw>
- <https://nptel.ac.in/courses/106/106/106106127/>

##### Suggested equivalent online courses

- <https://nptel.ac.in/courses/106/105/106105151/>
- <https://nptel.ac.in/courses/106/105/106105171/>
- [https://onlinecourses.swayam2.ac.in/cec19\\_mg35/preview](https://onlinecourses.swayam2.ac.in/cec19_mg35/preview)

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Jaya

Abhilasha Kumar



**PART D: Assessment and Evaluation**

<b>Internal Assessment : Continuous Comprehensive Evaluation (CCE) : 25 Marks</b>		<b>External Assessment: University Exam (UE) : 75 Marks</b> Time : 02.00 Hours	
<b>Internal Assessment</b>	<b>Marks</b>	<b>External Assessment</b>	<b>Marks</b>
Hands-on Lab Practice	5 Marks	Practical record file	10 Marks
Lab Test from practical list & internal viva	12 Marks	Viva voce on practical	15 Marks
Assignments (Charts/ Model/ Seminar / Rural Service/ Technology Dissemination/ Report of Excursion/ Lab Visits/ Survey / Industrial visit)	8 Marks	Table works/ Experiments	50 Marks
<b>Total</b>	<b>25 Marks</b>	<b>Total</b>	<b>75 Marks</b>

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.

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Abhilasha Kumar