PART A: Introduction				
Program: **Certificate**		Class: **B.C.A.**	Year: **I Year**	Session: **2021-22**

1.	Course Code	**S1- BCAA1T**
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 :** • 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

	Computer memory and its types, Storage devices: Magnetic tapes, Floppy Disks, Hard Disks, Compact Disc – CD-ROM, CD-RW, VCD, DVD, DVD-RW, usb drives, Blue Ray Disc, SD/MMC Memory cards.	
III	**Fundamentals of Digital Electronics**: Data Types, Complements, Fixed-Point Representation, Floating-Point Representation, Binary and other Codes, Error Detection Codes. **Logic Gates**, Boolean Algebra, Map Simplification, Combinational Circuits, Sequential Circuits, simple combinational circuit design problems. **Combinational Circuits-** Adder- Subtractor, Multiplexer, Demultiplexer, Decoders, Encoders **Sequential Circuits** - Flip - Flops, Registers, Counters.	10
IV	**Basic Computer Organization**: Instruction codes, Computer Registers, Computer Instructions, Timing & Control, Instruction Cycles, Memory Reference Instruction, Input - Output & Interrupts Instruction formats, Addressing modes, Instruction codes, Machine language, Assembly language. **Register Transfer and Micro operations**: Register Transfer Language, Register Transfer, Bus & Memory Transfer, Arithmetic Micro-operations, Logic Micro-operations, Shift Micro-operations.	10
V	**Processor and Control Unit**: 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. Pipelining – concept of pipelining, introduction to Pipelined data path and control – Handling Data hazards & Control hazards.	10
VI	**Memory and I/O Systems** - Peripheral Devices, I/O Interface, **Data Transfer Schemes** - Program Control, Interrupt, DMA Transfer. I/O Processor. **Memory Hierarchy**, Processor vs. Memory Speed, High-Speed Memories, Main memory & its types, Auxiliary memory, Cache Memory, Associative Memory, Interleaving, concept of Virtual Memory, Hardware support for Memory Management.	10
VII	**Indian contribution to the field** – 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. **Parallel Computing projects of India** – PARAM, ANUPAM, FLOSOLVER, CHIPPS etc. Other relevant contributors and contributions.	2
PART C: Learning Resources	
	Textbooks, Reference Books, Other Resources	

Suggested Readings

Textbooks:

1. M.Morris Mano, "Computer System Architecture", PHI.
2. Heuring Jordan , "Computer System Design & Architecture" (A.W.L.)
   3. म़ध्य 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
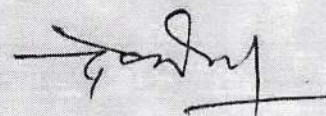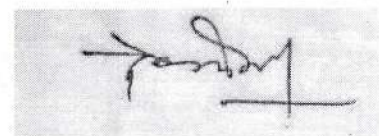
Suggestive digital platform web links
https://www.youtube.com/watch?v=4TzMyXmzL8M
https://nptel.ac.in/courses/106/106/106106166/
https://nptel.ac.in/courses/106/106/106106134/

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)	
Class Test III (**Based on solving circuit design problems)**	8 Marks		04 x 09 = 36 Marks
		Section (C): Two Long Questions (500 Words Each)	02 x 15 = 30 Marks
Total	**25 Marks**	Total	**75 Marks**
Any remarks/suggestions:			

	PART A: Introduction			
Program: **Certificate**		Class: **B.C.A**	Year: **I Year**	Session: **2021-22**

1.	Course Code	S1-BCAA1P
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)	**After the completion of this course, a successful student will be able to do the following:** • 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.**
I. Computer Fundamentals 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. II. Digital Electronics 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	30 Hrs.

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

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

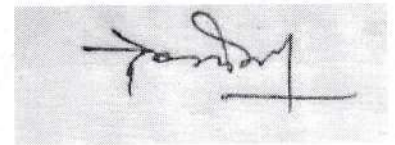https://nptel.ac.in/courses/106/105/106105163/
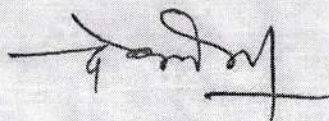
PART D: Assessment and Evaluation

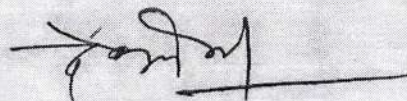| Internal Assessment : Continuous Comprehensive Evaluation (CCE) : **25 Marks**		External Assessment: University Exam (UE): **75 Marks** Time : **02.00 Hours**	
Internal Assessment	**Marks**	**External Assessment**	**Marks**
Hands-on Lab Practice	5 Marks	Practical record file	10 Marks
Viva	5 Marks	Viva 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 ***Excursion/ Lab visits/ Industrial*** ***Training is compulsory***	**25 Marks**	**Total**	**75 Marks**

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)	**After the completion of this course, a successful student will be able to do the following:** - 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

	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. **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.	
II	**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. **Constructor & Destructor:** Constructor, Parameterized Constructor, Multiple Constructors in a Class, Constructors with Default Arguments, Dynamic Initialization of Objects, Copy Constructor, Dynamic Constructor and Destructor.	10
III	**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.	8
IV	**Data Structure:** Basic concepts, Linear and Non-Linear data structures **Algorithm Specification:** Introduction, Recursive algorithms, Data Abstraction, Performance analysis. **Arrays:** Representation of single, two-dimensional arrays, triangular arrays, sparse matrices-array and linked representations. **Stacks:** Operations, Array and Linked Implementations, Applications-Infix to Postfix Conversion, Infix to Prefix Conversion, Postfix Expression Evaluation, Recursion Implementation. **Queues:** Definition, Operations, Array and Linked Implementations. Circular Queue-Insertion and Deletion Operations, Dequeue (Double Ended Queue), Priority Queue- Implementation.	12
V	**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 **Trees:** Representation of Trees, Binary tree, Properties of Binary Trees, Binary Tree Representations- Array and Linked Representations,	10

	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 O-07-462038-X
- Herbert Shildt, "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=BClS40yzssA
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
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.**
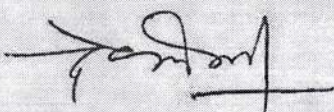
PART A: Introduction				
Program: **Certificate**		Class: **B.C.A.**	Year: **I Year**	Session: **2021-22**

1.	Course Code	S1-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)	**After the completion of this course, a successful student will be able to do the following:** 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.
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. 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

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.
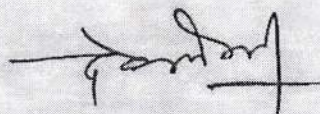
PART C: Learning Resources

Textbooks, Reference Books, Other Resources

Suggested Readings
- J. R. Hanly and E. B. Koffman, "Problem Solving and Program Design in C", Pearson, 2015
- E. Balguruswamy, "C++", TMH Publication ISBN O-07-462038-X
- Herbert Shildt, "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=BClS40yzssA
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
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 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 *Excursion/ Lab visits/ Industrial Training is compulsory*	**25 Marks**	**Total**	**75 Marks**