St. Paul Institute of Professional Studies, Indore

An Autonomous Institute Affiliated to Devi Ahilya Vishwavidhyalaya, Indore
Accredited by NAAC with 'A' Grade
Phone No. 0731-2499911, 49661355, 4961356
E-mail: info@spipsindore.ac.in, Website: www.spipsindore.com

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Part A-Introduction

Programme: Certificate/Diploma/Degree	Class: B.Sc. I Year	Session 2024-2025

Subject: Computer Science

Course Code	**BS-101T**
Course Title	**Computer System Architecture**
Course Type	Core Course
Pre-requisite	To study this course, a student must have had the subject Physics/Maths in XII standard.
Course Learning Outcomes	On completion of this course, learners will be able to: • Understand the basic structure, operation and characteristics of digital computer. • Be able to design simple combinational digital circuits based • on given parameters. • Familiarity with working of arithmetic and logic unit as well as the concept of pipelining. • Know about hierarchical memory system including cache memories and virtual memory. • Understand concept and advantages of parallelism, threading, multiprocessors and mulcore processors. • Know the contributions of Indians in the field of computer • Understand architecture and related technologies
Credit Value	**Theory 4 Credits Practical 2 Credits**
Total Marks	**Max marks: 30 +70 = 100 Minimum Passing Marks 35**

Part B: Content of the Course

No. of Lectures (in hours per week): **4 Hrs. per week** Total No. of Lectures: **60 Hrs.**		
Unit	**Topic**	**No. of lectures**
1	**Fundamentals of Digital Electronics**: Data Types, Complements, Fixed-Point Representation, Floating-Point Representation, Binary & other Codes, Error Detection Codes. Logic Gates, Boolean Algebra, Map Simplification, Combinational Circuits, Sequential Circuits, simple combinational circuit design. Circuits: Adder, Subtractor, Multiplexer, Demultiplexer, Decoders, Encoders, Flip - Flops, Registers, Counters. **Basic Computer Organization:** Instruction codes, Computer Registers, Computer Instructions, Timing & Control, Instruction Cycles, Memory Reference Instruction, Input - Output & Interrupts, Complete Computer Description & Design of Basic Computer.	12
2	**Instructions:** 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.	12
3	**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. **Memory and I/O Systems:** Peripheral Devices, I/O Interface. **Data Transfer Schemes:** Program Control, Interrupt, DMA Transfer. I/O Processor	12

4	**Memory Hierarchy:** Processor vs. Memory Speed, High-Speed Memories, Main Memory, Auxiliary Memory, Cache Memory, Associative Memory, Interleaving, Virtual Memory, Memory Management. **Parallelism:** Meaning, types of parallelism, introduction to Instruction-level-parallelism, Parallel processing challenges, Applications. **Flynn's classification:** Introduction to SISD, SIMD,MISD, MIMD **Hardware multithreading:** Introduction, types, advantages and applications. **Multicore processors:** Introduction, advantages, differences from multiprocessor.	12
5.	**Application Software :** Types, Database, Graphics, Education, Entertainment Software, Mobile App Software **Social Media Software:** Instant messaging, Email, Chatbot, Web Blogs. Free Open Source Software (FOSS). **Application Software uses:** Word Processing, Spreadsheet, Presentation, Database designing, Recording sound and video, Newsletter, Posters, Websites, Multimedia presentation, Audio, Video, Media Steaming and E-publications, Blog, Forum, Wiki, Social networking. **Using Office Tools:** MS Office Tools	12

Keywords/Tags: Digital Electronics, Logic Gates, Circuits, Instruction formats, Addressing Modes, Parallelism, Pipelining, Memory Hierarchy, Multicore, Multithreading, SISD, SIMD, MISD, MIMD, Graphics, Chatbot

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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://npte Lac. in/courses/106/106/106106166/
https://npteLac. in/courses/106/106/106106134/

Suggested equivalent online courses

https://npteLac.in/courses/ I 06/105/106105 I 63/

Part D- Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 100
Continuous Comprehensive Evaluation (CCE): 30 marks University Exam (UE) :70 marks

Internal Assessment: Continuous Comprehensive Evaluation (CCE):30	Class Test Assignment/Presentation E-quiz	30
External Assessment: University Exam Section: 70 Time : 03.00 Hours	Section(A) : Six Very Short Questions	06 x 01 = 06
	Section (B) : Five Short Questions	05 x 08 = 40
	Section (C) : Two Long Questions	02 x 12 = 24 Total 70

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Lab : Part A-Introduction

Programme : Certificate/Diploma/Degree   Class: B.Sc. I Year

Subject: Computer Science   Session 2024-2025

	Course Code	BS-101P
2	Course Title	**Computer Architecture Lab**
3	Course Type	Core Course
4	Pre-requisite	To study this course, a student must have had the subject Physics/Maths in 12th class.
5	Course Learning Outcomes	**On completion of this course, learners will be able to:** • 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. • Architecture and related technologies
6	Credit Value	**Practical 2 Credits**
7	Total Marks	Max marks: 30 +70 = 100 Minimum Passing Marks 35

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Part B: Content of the course
No. of Lab. Practical (in hours per week): 2 Hrs. per week
Total No. of Labs: 30 Hours

Suggestive list of Practical

a) System Architecture
1. To study basic gates (AND, OR, NOT) and verify their truth tables.
2. To convert a given binary number to Gray code using IC 7486.
3. To study and verify NAND as Universal gate using IC 7400.
4. To study half adder using basic gates and verify its truth table.
5. To study Full Adder using basic gates and verify its truth table.
6. To realize basic gates (AND, OR, NOT) from Universal gates (NAND and NOR).
7. To verify truth table of 4-bit adder using IC 7483.
8. To design and construct RS flip Flop using gates and verify the truth table.
9. To design and construct JK flip Flop using gates and verify the truth table.
10. To verify DeMorgan's Theorem.

b) MS Office Tools

Text Editor Tool
1. Create a document and apply different Editing options.
2. Create Banner for your college.
3. Design a Greeting Card using Word Art for different festivals.
4. Design your Bio data and use page borders and shading.
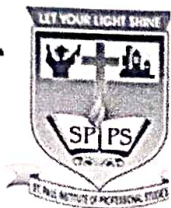
Spreadsheet Tool
1. Design your class Timetable.
2. Prepare a Mark Sheet of your class result.
3. Prepare a Salary Slip of an employee of an organization.
4. Prepare a bar chart & pie chart for analysis of Election Results.

Presentation Tools
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.

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
- V. Carl Hamacher , "Computer Organization", TMH
- Tannenbaum, "Structured Computer Organization", **PHI .**

Suggestive digital platform web links :

https://www.youtube.com/watch?v=4TzMyXrnzL8M

https://nptel.ac. in/courses/106/106/106106 166/

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): **30 Marks**		**External Assessment:** University Exam (UE) – **70 Marks** Time: **02.00 Hours**	
Internal Assessment	**Marks**	**External Assessment**	**Marks**
Hands-on Lab Practice	10 Marks	Practical record file	10 Marks
Mock Viva	5 Marks	Viva voce practical	20 Marks
Lab Test from practical list	7 Marks	Table works/ Exercise Assigned (02) in practical exam	30 Marks
Assignments (Charts/ Models) 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**	**30 Marks**	Total	**70 Marks**

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PART A- Introduction

Program: Certificate/Diploma/Certificate	Class: B.Sc. I Year		Session:2024-2025
Subject: Computer Science			

1	Course Code	**BS-102T**
2	Course Title	**Programming Methodologies & Data Structures**
3	Course Type	Core Course
4	Pre-Requisite	To study this course, a student must have had the subject Physics/Maths in 12 class.
5	Course Learning Outcomes	On completion of this course, learners will be able to: 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. Will be familiar with fundamental data structures, their implementation; become accustomed to the description of algorithms in both functional and procedural styles 6. Have knowledge of complexity of basic operations like insert, delete, search on these data structures. 7. Possess ability to choose a data structure to suitably model any data used in computer applications. 8. Design programs using various data structures including hash tables, Binary and general search trees, heaps, graphs etc. 9. Assess efficiency trade-offs among different data structure implementations. 10. Implement and know the applications of algorithms for searching and sorting etc. 11. Know the contribution of Indians in the field of programming and data structures.
7	Credit value	**Theory 4 Credits Practical 2 Credits**
8	Total Marks	Max marks: **30 +70** Minimum Passing Marks **35**

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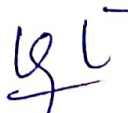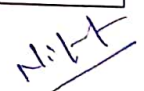
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PART B- Content of the Course

Total no. of Lectures (in hours per week): -   4 hrs per week   Total Lectures: - 60 hrs

Unit	Topic	No. of Lectures
I	**Introduction to Programming** - Program Concept, Characteristics of Programming, Stages in Program Development, Algorithms, Flowcharts, Types of Programming Methodologies. **Introduction to C++ Programming** - Basic Program Structure In C++, Data Types, Variables, Constants, Operators and Basic I/O. **Variables & Expressions** - 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.) Simple Expressions in C++ (including Unary Operator Expressions, Binary Operator Expressions), Understanding Operators Precedence in Expressions **Control Statements:** Conditional Statements if construct, switch-case construct. Iterative Statements while, do-while, and for loops, Use of break and continue in Loops, Using Nested Statements (Conditional as well as Iterative)	14
II	**Functions:** 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. **Structures and Unions:** Declaration and Initialization. **Pointers:** Introduction, Referencing, Dereferencing and operations. **File Handling** - Use of files for data input and output, merging and copying files.	10

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III	**Data Structures** - Basic concepts, Linear and Non-Linear data Structures, Algorithm Specification-Introduction. **Arrays:** Introduction to Arrays - Declaration and Referring Arrays, Arrays in Memory, Initializing Arrays. single, two-dimensional arrays, Multi-dimensional Arrays, Arrays in function. Sparse Matrices. **Strings** - Reading and Writing Strings, Arrays of Strings, String Function, Strings and Structure, Standard String Library Functions. **Linked Lists:** Singly Linked Lists, Operations, Concatenating, circularly linked lists-Operations for Circularly linked lists, Doubly Linked Lists- Operations.	12
IV	**Stacks-** Operations, Array and Linked Applications, Infix to Postfix 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. **Trees & Graphs-** Representation of Trees, Binary tree, Properties, Binary Tree Representations-Array and Linked Representations, Binary Tree Traversals, Threaded Binary Trees, Binary Search Trees, AVL Trees, Heap. **Graphs** - Graph ADT, Graph Representations, Graph Traversals	14
V	**Sorting & Searching :** Sorting Methods: Bubble Sort, Insertion Sort, Selection Sort, Quick Sort, Merge Sort, Comparison of Sorting Methods **Searching Algorithms** - Linear Search, Binary Search. **Hashing-** Introduction, Hash tables, Hash functions. **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.	10
Keywords/ Tags	Programming, C++, Data Structures, Expressions, Control, File Handling, Arrays, Stack, Queue, Linked List, Tree, Graph, Structure, Union, Hash, Search, Sort, Algorithm	

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PART C- Learning Resources

Textbooks/ Reference Books:

Suggested Readings:

1. Problem Solving and Program Design in C, J. R. Hanly and E. B. Koffman, Pearson, 2015
2. E. Balguruswamy, "C++ "TMH Publication ISBN 0-07-462038-X
3. Herbertz Shield, "C++ The Complete Reference "TMH Publication ISBN 0-07-463880-7
4. R. Lafore, 'Object Oriented Programming C++"
5. N. Dale and C. Weems, Programming and problem solving with C++: brief edition, Jones & Bartlett Learning.
6. Adam Drozdek, "Data Structures and algorithm in C++", Third Edition, Cengage Learning.
7. Sartaj Sahani, Data Structures, Algorithms and Applications with C++, McGraw Hill.
8. Robert L. Kruse, "Data Structures and Program Design in C++", Pearson.
9. D.S. Malik, Data Structure using C++, Second edition, Cengage Learning.
10. M. A. Weiss, Data structures and Algorithm Analysis in C, 2nd edition, Pearson.
11. Lipschutz: Schaum's outline series Data structures, Tata McGraw-Hill

Suggested Digital Platforms, Web Links:

1. https://www.youtube.com/watch?v=BCIS40yzssA
2. https://www.youtube.com/watch?v=vLnPwxZdW4Y&v1=en
3. https://www.youtube.com/watch?v=Umm1Z051tZw
4. https://npteLac. in/courses/106/106/106106127/

Suggested equivalent online courses

1. https://npteLac.in/courses/106/105/106105151/
2. https://nptel.ac.in/courses/106/105/106105171/
3. https://onlinecourses.swayam2.ac.in/cec19 m g35/prev iew

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Part D- Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: 100 Continuous Comprehensive Evaluation (CCE): 30 marks University Exam (UE) :70 marks		
Internal Assessment: Continuous Comprehensive Evaluation (CCE):30	Class Test Assignment/Presentation E-quiz	30
External Assessment: University Exam Section: 70 Time : 03.00 Hours	Section(A) : Six Very Short Questions	06 x 01 = 06
	Section (B) : Five Short Questions	05 x 08 = 40
	Section (C) : Two Long Questions	02 x 12 = 24 Total 70

Part A-Introduction

Programme : Certificate/Diploma/Degree Subject: Computer Science		Class: B.Sc. I Year	Session 2024-25
	Course Code	BS-102P	
2	Course Title	Office Tools & Programming Methodology Lab	
3	Course Type	Core Course	
4	Pre-requisite	To study this course, a student must have had the subject Physics/Maths in 12 class.	
5	Course Learning Outcomes	On completion of this course, learners will be able to: 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. Implementation of algorithms for searching and sorting.	
6	Credit Value	Practical 2 Credits	
7	Total Marks	Max marks:30 +70	Minimum Passing Marks 35

PART B: Content of the Course

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

Total No. of Lab – 30 Hours

Suggestive list of Practical –

I Office Tools

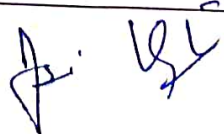|	
a. Using a Text Editor Tool	1. Create a document and insert header and footer, page title, date, time, apply various page formatting features etc. 2. Implement Mail Merge. 3. Insert a table into a document and try different formatting options for the table
b. Using a Spreadsheet Tool	1. Prepare a generic Bill of a Super Market. 2. 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. 3. 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. 4. 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 illustrating insertion of movie, animation and sound. 2. Illustrate use of custom animation and slide transition (usin(2, different effects). 3. 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. To learn elementary techniques involving arithmetic operators and mathematical expressions,
2. appropriate use of selection (if, switch, conditional operators) and control structures.
3. Learn how to use functions and parameter passing in functions, writing recursive programs.
4. Write a program to swap the contents of two variables.
4. Write a program for finding the roots of a Quadratic Equation.
5. Write a program to find area of a circle, rectangle, square using switch case.
6. Write a program to check whether a given number is even or odd.
7. Write a program to print table of any number.
8. Write a program to print Fibonacci series.
9. Write a program to find factorial of a given number.
10. Write a program to convert decimal (integer) number into equivalent binary number.
11. Write a program to check given string is palindrome or not.
12. Write a program to perform multiplications of two matrices.
13. Write a program to print digits of entered number in reverse order.
14. Write a program to print sum of two matrices.
15. Write a program to print multiplication of two matrices.
16. Write a program to generate even/odd series from 1 to 100.
17. Write a program whether a given number is prime or not.
18. Write a program for call by value and call by reference.
19. Write a program to generate a series   1+1/1 !+2/2!+3/3!+---+n/n!
20. Write a program to create a pyramid structure
    *
    **
    ***
    ****

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

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Part C

Suggested Readings: Textbooks, Reference Books, Other Resources:

1. J. R. Hanly and E. B. Koffman, "Problem Solving and Program Design in C", Pearson, 2015
2. E. Balguruswamy, "C++", TMH Publication ISBN 0-07-462038-X
3. Herbert Shildt, "C++ The Complete Reference "TMH Publication ISBN 0-07-463880-7
4. मध्य प्रदेश हिंदी ग्रंथ अकादमी से प्रकाशित विषय से संबंधित पुस्तक
5. R. Lafore, 'Object Oriented Programming C++
6. N. Dale and C. Weems, "Programming and problem solving with C++: brief edition", Jones & Bartlett Learning.
7. Adam Drozdek, "Data Structures and algorithm in C++". Third Edition, Cengage Learning.
8. Sartaj Sahani, "Data Structures, Algorithms and Applications with C++", McGraw Hill.
9. Robert L. Kruse, "Data Structures and Program Design in C++", Pearson.
10. D.S. Malik, "Data Structure using C++", Second edition, Cengage Learning.
11. M. A. Weiss, "Data structures and Algorithm Analysis in C", 2nd edition, Pearson.
12. Lipschutz, "Schaum's outline series Data structures". Tata McGraw-Hill

Suggestive digital platform web links:

1. https://www.youtube.com/watch?v=BCIS40yzssA
2. https://www.youtube.com/watch?v=yLnPwxZdW4Y&vl=en
3. 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 placed	Udemy

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PART D: Assessment and Evaluation			
Internal Assessment: Continuous Comprehensive Evaluation (CCE): 30 **Marks**		**External Assessment:** University Exam (UE) – **70 Marks** Time: **02.00 Hours**	
Internal Assessment	**Marks**	**External Assessment**	**Marks**
Hands-on Lab Practice	10 Marks	Practical record file	10 Marks
Mock Viva	5 Marks	Viva voce practical	20 Marks
Lab Test from practical list	7 Marks	Table works/ Exercise Assigned (02) in practical exam	30 Marks
Assignments (Charts/ Models) 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**	**30 Marks**	Total	**70 Marks**

Part A - Introduction	
Program: Certificate/Diploma/ Degree **Class:** B.Sc. I Year **Session:** 2024-2025	
Subject: Physics	

1.	Course Code	**BS-103T**
2.	Course Title	**Mechanics and General Properties of Matter**
3.	Course Type (Core/Elective/Generic Elective/Vocational/...)	**Minor**
4.	Pre- requisite (If any)	To study this course, a student must have had the subject Physics in 12th class.
5.	Course Learning Outcomes (CLO)	The course would empower the students to develop the idea about the behavior of physical bodies. 1. It will provide the basic concepts related to the motion of all the objects around us in daily life. 2. The students would be able to build foundation to various applied field in science and technology especially in the field of mechanical engineering. 3. The students will acquire the knowledge of basic 4. mathematical methods to solve the global various problems in physics. 5. The students will be able the understand the relativistic effect and the relation between energy and mass.
1.	Credit Value	**Theory 4 Credits Practical 2 Credits**
2.	Total Marks	Max. Marks: **30+70** Min. Passing Marks: **35**

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Unit	Part B - Content of the Course	
	Total number of Lectures (in hours): 60	
	Topics	**Number of Lectures**
I	**Historical background and Mathematical Physics** **1.Historical background:** 1.1. A brief historical background of mathematics and mechanics in the context of India and Indian culture. 1.2. A brief biography of Varahanihira and Vikram Sarabhai with their major contribution to science and society. **2. Mathematical Physics:** 2.1. Scalar and vector fields, Gradient of a scalar field and its physical significance. 2.2. Vector integral: line integral, surface integral and volume integral, Divergence of a vector field and its physical significance, Gauss divergence theorem. 2.3. Curl of a vector field and its physical significance, Stokes and Green's theorem. Numerical problems based on the above topics. **Keywords/Tags:** Scalar field, Vector field, Vector integral, Gradient, Divergence, Curl.	12
II	**Mechanics of Rigid and deformable bodies** **1. Rigid body mechanics:** 1.1. System of particles and concept of Rigid body, Torque, Centre of mass : position of the Centre of mass, Motion of the Centre of mass, Conservation of linear & angular momentum with examples, Single stage and multistage rocket. 1.2. Rotatory motion and concept of moment of inertia, Theorems on moment of inertia: theorem of addition, theorem of perpendicular axis, theorem of parallel axis, Calculation of moment of inertia of rectangular lamina, disc, solid cylinder, solid sphere. **2. Mechanics of deformable bodies:** 2.1. Hook's law, Young's modulus, Bulk modulus, Modulus of rigidity and Poisson's ratio, Relationship between various elastic moduli. 2.2. Possible values of Poisson's ratio, Finding Poisson's ratio of rubber in the laboratory, Torsion of a cylinder, Strain energy of twisted cylinder. 2.3. Finding the modulus of rigidity of the material of a wire by Barton's method, Torsional pendulum and Maxwell's needle, Searl's method to find Y, ri and a of the material of a wire, Bending of beam, Cantilever, Beam supported at its ends and loaded in the middle. **Keywords/Tags:** Rigid body, Centre of mass, Moment of inertia, Poisson's ratio.	12

III	**Fluid mechanics**	12
	1. Surface Tension:	
	1.1. Inter-molecular forces and potential energy curve, force of cohesion and adhesion.	
	1.2. Surface tension, Explanation of surface tension on the basis of intermolecular forces, Surface energy, Effect of temperature and impurities on surface tension, Daily life application of surface tension.	
	1.3. Angle of contact, The pressure difference between the two sides of a curved liquid surface, Excess pressure inside a soap bubble, Capillarity, determination of surface tension of a liquid - capillary rise method, Jaeger's method.	
	2. Viscosity:	
	2.1. Ideal and viscous fluid, Streamline and turbulent flow, Equation of continuity, Rotational and irrotational flow, Energy of a flowing fluid, Euler's equation of motion of a non-viscous fluid and its physical significance.	
	2.2. Bernoulli's theorem and its applications (Velocity of efflux, shapes of wings of airplane, Magnus effect, Filter pump, Bunsen's burner).	
	2.3. Viscous flow of a fluid, Flow of liquid through a capillary tube, Derivation of Poiseuille's formula and limitations, Stocks formula, Motion of a spherical body falling in a viscous fluid.	
	Keywords/Tags: Inter-molecular force, Surface tension, Angle of contact, Capillarity, Viscosity, Euler's equation, Poiseuille's formula.	

IV	**Gravitational potential and Central forces**	12
	1. Gravitational potential:	
	1.1. Conservative and non-conservative force field, Conservation of energy in motion under the conservative and non-conservative forces, Potential energy.	
	1.2. Conservative force, Conservation of energy, Gravitational potential and gravitational potential energy, Gravitational potential and intensity of gravitational field due to a uniform spherical shell and a uniform solid sphere.	
	1.3. Gravitational self-energy, Gravitational self-energy of a uniform spherical shell and a uniform solid sphere.	
	2. Central forces:	
	2.1. Motion under Central forces, Conservative characteristics of central forces.	
	2.2. The motion of a two particles system in Central force, Concept of reduced mass, Reduced mass of positron ium and hydrogen.	
	2.3. Motion of particles in an inverse-square central force, Motion of celestial bodies and derivation of Kepler's laws,	
	2.4. Elastic and inelastic scattering (elementary idea).	
V	**Relativistic Mechanics and Astrophysics**	12
	Relativistic Mechanics:	
	1.1. Frarne of references, Galilean transformation, Michelson- Morley experiment.	
	1.2. Postulates of special theory of relativity, Lorentz Transformation, Simultaneity and order of events, Length contraction, Time dilation, Relativistic transformation of velocities, Variation of mass with velocity.	
	1.3. Mass-energy equivalence and its experimental verification.	
	Astrophysics:	
	2.1. Introductionn to the Universe, Properties of the Sun, Concept of Astronomical Distance.	
	2.2. Life cycle of a stars, Chandrasekhar Limit, H-R diagram, Red giant star, White dwarf star, Neutron star, Black hole,	
	2.3.Big Bang Theory (elementary idea).	
	Keywords/Tags: Transformation, Mass-energy equivalence,	

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Part C- Learning Resources
Text Books, Reference Books, Other resources

Suggested Readings:
1. Spiegel M. R., "Vector Analysis: Schaum Outline Series", McGraw Hill Education, 2017.
2. Mathur D. S., "Mechanics", S. Chand, 2012.

Ghatak A. K., Goyal I.C. and Chua S.J., "Mathematical Physics", Laxmi Publications Private Limited, 2017.
4. Mathur D. S., "Properties of Matter", Shyamlal Charitable Trust, New Delhi.
5. Sears and Zeemansky, "University Physics", Pearson Education.

Suggested equivalent online courses:
1. https://nptel.ac.iri/courses/115/103/115103036/ Mathematical Physics by Dr. Saurabh Basu , Department of Physics, Indian Institute of Technology Guwahati
2. https://npte 1 .ac. in/courses/115/106/115106090/ Mechanics, Heat, Oscillations and Waves by Prof. V. Balakrishnan, Department of Physics, Indian Institute of Technology, Madras

Part D- Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: 100 Continuous Comprehensive Evaluation (CCE): 30 marks University Exam (UE) :70 marks		
Internal Assessment: Continuous Comprehensive Evaluation (CCE):30	Class Test Assignment/Presentation E-quiz	30
External Assessment: University Exam Section: 70 Time : 03.00 Hours	Section(A) : Six Very Short Questions	06 x 01 = 06
	Section (B) : Five Short Questions	05 x 08 = 40
	Section (C) : Two Long Questions	02 x 12 = 24 Total 70

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Part A - Introduction		
Program: Certificate/Diploma/Degree	**Class: B.Sc. I Year**	**Session: 2024-2025**
Subject: Physics		
1.	Course Code	BS-103P
2.	Course Title	Mechanics and General Properties of Matter Lab
3.	Course Type (Core/Elective/Generic Elective/Vocational/...)	Minor
4.	Pre- requisite (If any)	To study this course, a student must have had the subject Physics in 12th class.
5.	Course Learning Outcomes (C LO)	1. The students would acquire basic practical knowledge related to mechanics through the experiments. 2. Students will be familiar with various measurement devices by which they can measure various physical quantities with accuracy. 3. The students will develop the concept related to the mechanics and properties of matter.
6.	Credit Value	2
7.	Total Marks	Max. Marks: 30+70 Min. Passing Marks: 35

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Sr. No.	Part B - Content of the Course	
	Total numbers of Practical (in hours): 30 List of experiments	Number of Practical (in hours)
1.	Determination of Young's modulus, modulus of rigidity and Poisson's ratio of material of a wire using Searle's method.	30
2.	Determination of Young's modulus of material of a metallic bar by bending of beam method.	
3.	Determination of acceleration due to gravity (g) using Bar pendulum.	
4.	Determination of acceleration due to gravity (g) using Kater's reversible pendulum.	
5.	Determination of modulus of rigidity of a rod with the help of Barton's apparatus.	
6.	Determination of coefficient of viscosity of liquid using	
7.	Determination of the moment of inertia of a flywheel about its axis of rotation.	
8.	Determination of the moment of inertia of a given body (irregular body) with the help of inertia table.	
9.	Verification of laws of the parallel/perpendicular axes of moment of inertia.	
10.	Determination of modulus of rigidity of material of a wire with the help of Maxwell's needle.	
11.	Determination of Young's Modulus of a material of a rod using Cantilever method.	
12.	Determination of modulus of rigidity of material of a wire with the help of torsional pendulum.	
13.	Determination of force constant of a spring.	
14.	Determination of Poisson's ratio of rubber.	
15.	Determination of surface tension of a liquid by Jaeger's method.	

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Part C-Learning Resources
Text Books, Reference Books, Other resources

Suggested Readings:
1. Prakash I. & Ramakrishna, "A Text Book of Practical Physics", Kitab Mahal, 2011,11/e.
2. Squires G. L., "Practical Physics", Cambridge University Press, 2015, 4/e.
3. Flint B. L. and Worsnop H. T., "Advanced Practical Physics for students", Publishing House, 197.
4. Chattopadhyay D. & Rakshit P. C., "An Advanced Course in Practical Physics", Central Book Agency.

Suggestive digital platforms web links
1. https://www.vlab.co.in/broad-area-physical-sciences

2. https://storage.cpleapis.com/uniquecourses/online.hrni

Part D-Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Internal Assessment	Marks	External Assessment	Marks
Class Interaction /Quiz	10	Viva Voce on Practical	10
Attendance	10	Practical Record File	10
Assignments (Charts/ Model Seminar / Rural Service/ Technology Dissemination/ Report of Excursion/ Lab Visits/ Survey / Industrial visit)	10	Table work / Experiments	50
TOTAL	30		70