



Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore
Shri Vaishnav Institute of Information Technology
 Choice Based Credit System (CBCS) in the light of NEP-2020
 Diploma CSE/AI/DS/Cyber Security
 SEMESTER-III (2025-2028)

| COURSE CODE | CATEGORY | COURSE NAME | TEACHING & EVALUATION SCHEME | | | | | | L | T | P | CREDITS |
|-------------|----------|--------------------------------------|------------------------------|-------------------------|---------------|----------------------|-------------------------|----------------------|---|---|---|---------|
| | | | Marks | THEORY | | | PRACTICAL | | | | | |
| | | | | END SEM University Exam | Two Term Exam | Teachers Assessment* | END SEM University Exam | Teachers Assessment* | | | | |
| DTCS301 | DCC | Object Oriented Programming (Python) | Max | 60 | 20 | 20 | 30 | 20 | 3 | 0 | 2 | 4 |
| | | | Min | 24 | 16 | | 14 | 9 | | | | |

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

| COURSE OBJECTIVES: | |
|--|---|
| The student will have ability to: | |
| 1. | To understand fundamentals of Object-Oriented Programming concepts |
| 2. | To learn Python programming syntax and constructs. |
| 3. | To apply OOP concepts using Python for problem solving. |
| 4. | To develop real-world applications using Python. |
| COURSE ALIGNMENT WITH UNSDG: | |
| The Course aims to fulfill the United Nations Sustainable Development Goals, SDG 4 (Quality Education) and SDG 9 (Industry, Innovation and Infrastructure) . | |
| COURSE OUTCOMES: | |
| After completion of the course, the student will be able to: | |
| CO1 | Student will be able to understand Python programming fundamentals. |
| CO2 | Student will be able to develop programs using control structures and functions. |
| CO3 | Student will be able to apply OOP concepts like classes, inheritance and polymorphism. |
| CO4 | Student will be able to build Python-based applications. |
| TEACHING PEDAGOGY: | |
| T1 | Classroom teaching (white board), Power Point Presentations, Interactive lectures, Inquiry-based teaching |
| T2 | ABL activities, Assignments, Flip Class/ Seminars, Quizzes, Oral Viva-voce examination |
| ASSESSMENT TOOLS: | |
| ATL1 | Quiz |
| ATL2 | Activity Based Learning |
| ATL3 | Midterm Exams |
| ATL4 | Flip Class |

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| | |
|------|----------------------------|
| ATL5 | Seminar Presentation |
| ATL6 | Assignments |
| ATL7 | Poster |
| ATL8 | Oral Viva-voce examination |
| ATL9 | Industrial Visit Report |

PREREQUISITES:

Basic Computer Knowledge.

SYLLABUS:

| Module | Descriptors/Topics | Hours | Assessment Tools |
|--------------------|---|-----------|----------------------|
| I | Introduction to Python: Features, installation, execution, syntax, variables, data types, operators, input/output operations. | 9 | ATL1 ATL3 ATL6 |
| II | Control Structures: Conditional statements, loops, functions, recursion, modules and packages. | 9 | ATL1 ATL3 ATL6 |
| III | Object-Oriented Programming: Classes, objects, constructors, inheritance, polymorphism, encapsulation, abstraction. | 9 | ATL1 ATL3 ATL6 |
| IV | Exception Handling and File Handling: Errors, exceptions, try-except statements, file operations, and modules. | 9 | ATL1 ATL3 ATL6 |
| V | GUI Programming: Introduction to Tkinter, widgets, event handling, mini project development. | 9 | ATL1 ATL3 ATL6 |
| Total Hours | | 45 | |

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| ADDITIONAL RESOURCES | | |
|-------------------------|---|------------|
| A. | Value addition to course content/ Skill enhancement content: | |
| | https://www.redhat.com/en/services/training/rh124-red-hat-system-administration-i | |
| B. | Remedial classes for slow learners: | |
| | As per the SVVV SOP for slow and fast learners. | |
| SUGGESTED READINGS: | | |
| Text Books: | | |
| 1. | Sweigart, A. <i>Automate the Boring Stuff with Python: Practical Programming for Total Beginners</i> . 2nd Edition, No Starch Press, 2019. | |
| 2. | Downey, A. B. <i>Think Python: How to Think Like a Computer Scientist</i> . 2nd Edition, O'Reilly Media, 2016. | |
| 3. | Ramalho, L. <i>Fluent Python: Clear, Concise, and Effective Programming</i> . 2nd Edition, O'Reilly Media, 2022. | |
| Reference Books: | | |
| 1. | Lutz, M. <i>Learning Python</i> . 5th Edition, O'Reilly Media, 2013. | |
| 2. | Beazley, D., & Jones, B. K. <i>Python Cookbook: Recipes for Mastering Python 3</i> . 3rd Edition, O'Reilly Media, 2013. | |
| 3. | McKinney, W. <i>Python for Data Analysis: Data Wrangling with Pandas, NumPy, and Jupyter</i> . 3rd Edition, O'Reilly Media, 2022. | |
| LIST OF PRACTICAL | | |
| S No. | Practical Title | CO Mapping |
| 1 | Installation and Setup of Python Environment and Execution of Basic Python Programs | CO1 |
| 2 | Programs Using Variables, Data Types, Literals, Constants, and Type Casting | CO1 |
| 3 | Implementation of Input and Output Functions Using <code>input ()</code> and <code>print ()</code> | CO1 |

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| | | |
|----|--|-----|
| 4 | Programs Based on Arithmetic, Relational, Logical, Assignment, Bitwise, Membership, and Identity Operators | CO1 |
| 5 | Programs Using Decision-Making Statements (if, if-else, if-elif-else) | CO2 |
| 6 | Programs Using Looping Statements (for, while, range(), break, continue, pass) | CO2 |
| 7 | List Operations: Creation, Accessing, Updating, Deletion, and Applications | CO2 |
| 8 | Tuple, Dictionary, and Set Operations with Built-in Functions | CO2 |
| 9 | Implementation of User-Defined Functions with Parameters and Return Values | CO2 |
| 10 | Programs Demonstrating Built-in Mathematical, String, and Type Conversion Functions | CO2 |
| 11 | File Handling Operations: Creating, Reading, Writing, and Appending Files | CO4 |
| 12 | Object-Oriented Programming: Classes, Objects, Attributes, and Methods in Python | CO3 |

COURSE ARTICULATION MATRIX (MAPPING OF COs WITH POs)

| Course Outcomes | | | | | | | | | | | | | Correlation with POs | | |
|-----------------|------|------|------|------|------|------|------|------|------|-------|-------|-------|----------------------|-------|-------|
| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
| CO1 | 3 | 2 | – | – | 2 | – | – | – | – | – | – | 1 | 3 | 1 | 1 |
| CO2 | 3 | 3 | 2 | 1 | 3 | – | – | – | – | – | – | 1 | 3 | 2 | 1 |
| CO3 | 3 | 2 | 3 | 1 | 3 | – | – | – | – | – | – | 1 | 2 | 3 | – |
| CO4 | 3 | 3 | 3 | 2 | 3 | – | – | – | 1 | 1 | 1 | 2 | 3 | 3 | – |

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| | | | Marks | THEORY | | | PRACTICAL | | | | | | |
| | | | | END SEM University Exam | Two Term Exam | Teachers Assessment* | END SEM University Exam | Teachers Assessment* | | | | | |
| DTCS302 | DCC | Computer Graphics | Max | 60 | 20 | 20 | 30 | 20 | 3 | 0 | 2 | 4 | |
| | | | Min | 24 | 16 | 14 | 9 | | | | | | |

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COURSE OBJECTIVES:

The student will have ability to:

1. To understand the fundamentals and applications of computer graphics.
2. To learn various algorithms used for drawing graphical primitives.
3. To study two-dimensional and three-dimensional transformations and viewing techniques.
4. To understand clipping, projection, and animation concepts in computer graphics.
5. To develop graphical applications using computer graphics principles and algorithms

COURSE ALIGNMENT WITH UNSDG:

The Course aims to fulfill the United Nations Sustainable Development Goals, **SDG 4 (Quality Education)** and **SDG 9 (Industry, Innovation and Infrastructure)**.

COURSE OUTCOMES:

After completion of the course, the student will be able to:

- | | |
|------------|--|
| CO1 | Understand the basic concepts, components, devices, and applications of computer graphics systems. |
| CO2 | Implement line, circle, ellipse, and polygon drawing algorithms for graphical primitives. |
| CO3 | Apply 2D and 3D transformations, projections, and viewing techniques to graphical objects. |
| CO4 | Develop simple graphical applications using clipping, animation, and multimedia concepts. |

TEACHING PEDAGOGY:

- | | |
|-----------|---|
| T1 | Classroom teaching (white board), Power Point Presentations, Interactive lectures, Inquiry-based teaching |
| T2 | ABL activities, Assignments, Flip Class/ Seminars, Quizzes, Oral Viva-voce examination |

ASSESSMENT TOOLS:

- | | |
|-------------|-------------------------|
| ATL1 | Quiz |
| ATL2 | Activity Based Learning |
| ATL3 | Midterm Exams |
| ATL4 | Flip Class |
| ATL5 | Seminar Presentation |

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| | |
|------|----------------------------|
| ATL6 | Assignments |
| ATL7 | Poster |
| ATL8 | Oral Viva-voce examination |
| ATL9 | Industrial Visit Report |

PREREQUISITES:

- Basic Computer Knowledge
- Fundamentals of Mathematics
- Basic Programming Concepts

SYLLABUS:

| Module | Descriptors / Topics | Hours | Assessment Tools |
|--------|---|-------|------------------|
| I | Introduction to Computer Graphics: Introduction, Definition, Applications of Computer Graphics, Components of Graphics System, Raster Scan and Random Scan Displays, Display Devices (CRT, LCD, LED), Input Devices (Keyboard, Mouse, Light Pen, Digitizer), Graphics Software, Overview of Scan Conversion. Line Drawing Algorithms: DDA Algorithm, Bresenham's Line Drawing Algorithm, Comparison and Applications. | 9 | ATL1, ATL3, ATL6 |
| II | Circle and Polygon Algorithms: Circle Drawing using Midpoint Circle Algorithm, Ellipse Drawing Algorithm, Polygon Representation, Polygon Filling Techniques: Scan Line Algorithm, Boundary Fill Algorithm, Flood Fill Algorithm, Introduction to Anti-Aliasing. | 9 | ATL1, ATL3, ATL6 |
| III | 2D Transformations: Translation, Rotation, Scaling, Reflection, Shearing, Matrix Representation of Transformations, Homogeneous Coordinates, Composite Transformations, Window-to-Viewport Transformation. | 9 | ATL1, ATL3, ATL6 |
| IV | 3D Graphics and Transformations: Introduction to 3D Graphics, 3D Transformations (Translation, Rotation, Scaling), 3D Viewing Pipeline, Parallel Projection, Perspective Projection, Introduction to Hidden Surface Removal Techniques. | 9 | ATL1, ATL3, ATL6 |
| V | Clipping and Introduction to Animation: Point Clipping, Line Clipping | 9 | ATL1, |

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| | |
|---|------------|
| (Cohen-Sutherland and Liang-Barsky Algorithms), Polygon Clipping (Sutherland-Hodgman Algorithm), Introduction to Computer Animation, Types of Animation, Basic Multimedia Concepts. | ATL3, ATL6 |
| Total Hours | 45 |

ADDITIONAL RESOURCES

A. Value addition to course content/ Skill enhancement content:

- OpenGL Programming Tutorials
- Computer Graphics Tutorials by NPTEL
- Blender Fundamentals
- <https://www.opengl.org>
- <https://nptel.ac.in>

B. Remedial classes for slow learners:

As per the SVVV SOP for slow and fast learners.

SUGGESTED READINGS:

Text Books:

1. D. Hearn and M. P. Baker, *Computer Graphics with OpenGL*, 4th ed. Upper Saddle River, NJ, USA: Pearson Education, 2011.
2. D. F. Rogers, *Procedural Elements for Computer Graphics*, 2nd ed. New York, NY, USA: McGraw-Hill, 1998.
3. S. Harrington, *Computer Graphics: A Programming Approach*, 2nd ed. New York, NY, USA: McGraw-Hill, 1987.

Reference Books:

1. J. D. Foley, A. van Dam, S. K. Feiner, and J. F. Hughes, *Computer Graphics: Principles and Practice*, 3rd ed. Boston, MA, USA: Addison-Wesley, 2014.
2. E. Angel and D. Shreiner, *Interactive Computer Graphics: A Top-Down Approach with OpenGL*, 7th ed. Boston, MA, USA: Addison-Wesley, 2015.

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3. R. Steinmetz and K. Nahrstedt, *Multimedia Systems*. Berlin, Germany: Springer, 2004.
4. F. S. Hill Jr. and S. M. Kelley, *Computer Graphics Using OpenGL*, 3rd ed. Upper Saddle River, NJ, USA: Pearson Education, 2007.
5. D. Salomon, *Curves and Surfaces for Computer Graphics*. New York, NY, USA: Springer, 2006.

SUGGESTED E-RESOURCES

1. National Programme on Technology Enhanced Learning (NPTEL), “Computer Graphics,” IIT Kharagpur. [Online]. Available: <https://nptel.ac.in>.
2. Khronos Group, “OpenGL Documentation and Resources.” [Online]. Available: <https://www.opengl.org>.
3. GeeksforGeeks, “Computer Graphics Tutorials.” [Online]. Available: <https://www.geeksforgeeks.org/computer-graphics>.
4. Tutorials Point, “Computer Graphics Tutorial.” [Online]. Available: https://www.tutorialspoint.com/computer_graphics.
5. MIT OpenCourseWare, “Introduction to Computer Graphics.” [Online]. Available: <https://ocw.mit.edu>.

LIST OF PRACTICAL

| S. No. | Practical Title | CO Mapping |
|--------|---|------------|
| 1 | Implementation of DDA Line Drawing Algorithm | CO1 |
| 2 | Implementation of Bresenham Line Drawing Algorithm | CO1 |
| 3 | Program for Midpoint Circle Drawing Algorithm | CO1 |
| 4 | Program for Ellipse Drawing Algorithm | CO2 |
| 5 | Implementation of Polygon Filling (Boundary Fill/Flood Fill) | CO2 |
| 6 | Program for 2D Transformations (Translation, Rotation, Scaling) | CO2 |
| 7 | Program for Composite Transformations | CO2 |
| 8 | Implementation of Line Clipping (Cohen-Sutherland Algorithm) | CO2 |
| 9 | Implementation of Polygon Clipping | CO3 |
| 10 | Simple Animation Program | CO3 |
| 11 | Mini Project on Graphical Application | CO4 |

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COURSE ARTICULATION MATRIX (MAPPING OF COs WITH POs)

| Course Outcomes | Correlation with POs | | | | | | | | | | | | Correlation with PSOs | | |
|-----------------|----------------------|------|------|------|------|------|------|------|------|-------|-------|-------|-----------------------|-------|-------|
| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO1 0 | PO1 1 | PO1 2 | PSO 1 | PSO 2 | PSO 3 |
| CO1 | 3 | 2 | 1 | 1 | 3 | - | - | - | 1 | 1 | - | 2 | 2 | 1 | 1 |
| CO2 | 3 | 3 | 3 | 2 | 3 | 1 | - | - | 2 | 1 | - | 2 | 3 | 2 | 2 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 1 | - | - | 2 | 1 | - | 2 | 3 | 3 | 2 |
| CO4 | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 3 | 2 | 1 | 3 | 3 | 3 | 3 |

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 Choice Based Credit System (CBCS) in the light of NEP-2020
 Diploma CSE/AI/DS/Cyber Security
 SEMESTER-III (2026-2029)

| COURSE CODE | CATEGORY | COURSE NAME | TEACHING & EVALUATION SCHEME | | | | | | L | T | P | CREDITS |
|-------------|----------|-------------|------------------------------|-------------------------|---------------|----------------------|-------------------------|----------------------|---|---|---|---------|
| | | | Marks | THEORY | | | PRACTICAL | | | | | |
| | | | | END SEM University Exam | Two Term Exam | Teachers Assessment* | END SEM University Exam | Teachers Assessment* | | | | |
| DTCS305 | SEC | Unix Lab | Max | 0 | 0 | 0 | 30 | 20 | 0 | 0 | 2 | 1 |
| | | | Min | 0 | 0 | 14 | 9 | | | | | |

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

| COURSE OBJECTIVES: | |
|--|--|
| The student will have ability to: | |
| 1. | To understand the architecture and working of Unix/Linux operating system. |
| 2. | To gain hands-on experience with Unix commands and utilities. |
| 3. | To develop shell scripting skills for automation and problem solving. |
| 4. | To understand file system, process management, and system-level operations. |
| 5. | To apply Unix/Linux tools and shell programming techniques for system administration and automation tasks. |
| COURSE ALIGNMENT WITH UNSDG: | |
| The Course aims to fulfill the United Nations Sustainable Development Goals, SDG 4 (Quality Education) and SDG 9 (Industry, Innovation and Infrastructure) . | |
| COURSE OUTCOMES: | |
| After completion of the course, the student will be able to: | |
| CO1 | Student will be able to efficiently use Unix/Linux commands for system operations. |
| CO2 | Student will be able to manage files, directories, and permissions in Unix environment. |
| CO3 | Student will be able to design and execute shell scripts for various applications. |
| CO4 | Student will be able to handle processes, scheduling, system utilities, and automate administrative tasks in Unix/Linux. |
| TEACHING PEDAGOGY: | |
| T1 | Classroom teaching (white board), Power Point Presentations, Interactive lectures, Inquiry-based teaching |
| T2 | ABL activities, Assignments, Flip Class/ Seminars, Quizzes, Oral Viva-voce examination |
| ASSESSMENT TOOLS: | |
| ATL1 | Quiz |
| ATL2 | Activity Based Learning |
| ATL3 | Midterm Exams |

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Diploma CSE/AI/DS/Cyber Security

SEMESTER-III (2026-2029)

| COURSE CODE | CATEGORY | COURSE NAME | TEACHING & EVALUATION SCHEME | | | | | | L | T | P | CREDITS |
|-------------|----------|-------------|------------------------------|-------------------------|---------------|----------------------|-------------------------|----------------------|---|---|---|---------|
| | | | Marks | THEORY | | | PRACTICAL | | | | | |
| | | | | END SEM University Exam | Two Term Exam | Teachers Assessment* | END SEM University Exam | Teachers Assessment* | | | | |
| DTCS305 | SEC | Unix Lab | Max | 0 | 0 | 0 | 30 | 20 | 0 | 0 | 2 | 1 |
| | | | Min | 0 | 0 | 14 | 9 | | | | | |

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

| | |
|------|----------------------------|
| ATL4 | Flip Class |
| ATL5 | Seminar Presentation |
| ATL6 | Assignments |
| ATL7 | Poster |
| ATL8 | Oral Viva-voce examination |
| ATL9 | Industrial Visit Report |

PREREQUISITES:

- Basic Computer Knowledge
- Operating System Fundamentals
- Basic Programming Concepts

SYLLABUS:

| Module | Descriptors / Topics | Hours | Assessment Tools |
|--------|---|-------|------------------|
| I | Introduction to Unix/Linux Operating System: History and features of Unix/Linux, architecture of Unix/Linux operating system, login and logout procedures, command structure and syntax. Basic Unix Commands: date, cal, who, whoami, tty, uname, clear, echo, passwd. Understanding command syntax, options, arguments and manual help commands (man, whatis, apropos, --help). | 6 | ATL1, ATL3, ATL6 |
| II | File and Directory Management: Unix file system structure, root directory, home directory, pathnames (absolute and relative). File and Directory Commands: ls, mkdir, rmdir, cd, pwd, cp, mv, rm, touch, cat, more, less. File viewing and editing basics. Wildcards and pattern matching (*, ?, []). File Permissions and Security: Read, write, execute permissions; chmod, chown, chgrp commands; symbolic and numeric permission representation. | 6 | ATL1, ATL3, ATL6 |
| III | Text Processing and Filters: Concept of filters and pipelines in Unix. Standard input, output and error streams. Text Processing Commands: grep, | 6 | ATL1, ATL3, ATL6 |

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|-------------|----------|-------------|------------------------------|-------------------------|---------------|----------------------|-------------------------|----------------------|---|---|---|---------|
| | | | Marks | THEORY | | | PRACTICAL | | | | | |
| | | | | END SEM University Exam | Two Term Exam | Teachers Assessment* | END SEM University Exam | Teachers Assessment* | | | | |
| DTCS305 | SEC | Unix Lab | Max | 0 | 0 | 0 | 30 | 20 | 0 | 0 | 2 | 1 |
| | | | Min | 0 | 0 | 14 | 9 | | | | | |

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| | | | |
|----|---|-----------|------------------|
| | egrep, fgrep, sort, uniq, wc, head, tail, cut, paste. Redirection and Piping: >, >>, <, operators. Combining commands using pipelines for efficient data processing. | | |
| IV | Shell Programming: Introduction to shell scripting and automation. Creating and executing shell scripts. Variables, environment variables, input/output operations. Operators: arithmetic, relational and logical operators. Control Structures: if, if-else, case, for, while, until loops. Functions, command-line arguments, debugging shell scripts. | 6 | ATL1, ATL3, ATL6 |
| V | Process Management and System Administration: Process concepts, process states and life cycle. Foreground and background processes. Process management commands: ps, top, jobs, bg, fg, kill, nice, renice. Process scheduling concepts. System administration commands: df, du, free, uptime, who, last. Cron and at commands. Introduction to system logs, disk and memory management. | 6 | ATL1, ATL3, ATL6 |
| | Total Hours | 30 | |

ADDITIONAL RESOURCES

| | |
|-----------|---|
| A. | Value addition to course content/ Skill enhancement content: |
| | <ul style="list-style-type: none"> Linux Foundation Training Resources Shell Scripting for Automation Linux System Administration Tutorials https://www.redhat.com/en/services/training/rh124-red-hat-system-administration-i |
| B. | Remedial classes for slow learners: |
| | As per the SVVV SOP for slow and fast learners. |

SUGGESTED READINGS:

| Text Books: | |
|-------------|--|
| 1. | S. Das, <i>Your UNIX: The Ultimate Guide</i> , 3rd ed. New Delhi, India: McGraw-Hill Education, 2017. |
| 2. | Y. Kanetkar, <i>Unix Shell Programming</i> . New Delhi, India: BPB Publications, 2017. |
| 3. | R. Stevens and S. Rago, <i>Advanced Programming in the UNIX Environment</i> , 3rd ed. Boston, MA, USA: |

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| COURSE CODE | CATEGORY | COURSE NAME | TEACHING & EVALUATION SCHEME | | | | | | L | T | P | CREDITS | |
|-------------|----------|-------------|------------------------------|-------------------------|---------------|----------------------|-------------------------|----------------------|---|---|---|---------|--|
| | | | Marks | THEORY | | | PRACTICAL | | | | | | |
| | | | | END SEM University Exam | Two Term Exam | Teachers Assessment* | END SEM University Exam | Teachers Assessment* | | | | | |
| DTCS305 | SEC | Unix Lab | Max | 0 | 0 | 0 | 30 | 20 | 0 | 0 | 2 | 1 | |
| | | | Min | 0 | 0 | 14 | 9 | | | | | | |

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| | |
|--|-----------------------|
| | Addison-Wesley, 2013. |
|--|-----------------------|

Reference Books:

1. S. Das, *Unix Concepts and Applications*, 5th ed. New Delhi, India: McGraw-Hill Education, 2017.
2. B. W. Kernighan and R. Pike, *The UNIX Programming Environment*. Englewood Cliffs, NJ, USA: Prentice Hall, 1984.
3. J. Peek, G. Todino and J. Strang, *Learning the UNIX Operating System*, 5th ed. Sebastopol, CA, USA: O'Reilly Media, 2001.
4. W. Shotts, *The Linux Command Line*, 2nd ed. San Francisco, CA, USA: No Starch Press, 2019.

Suggested E-Resources

- Linux Documentation Project. Available: <https://tldp.org>
- GNU Bash Manual. Available: <https://www.gnu.org/software/bash/manual>
- Linux Foundation Training. Available: <https://training.linuxfoundation.org>

LIST OF PRACTICAL

| S. No. | Practical Title | CO Mapping |
|--------|--|------------|
| 1 | Study and execution of basic Unix commands | CO1 |
| 2 | Practice of file and directory operations | CO1 |
| 3 | Implementation of file permissions using chmod | CO1 |
| 4 | Use of wildcards for pattern matching | CO2 |
| 5 | Text processing using grep, sort, uniq and wc | CO2 |
| 6 | Implementation of input-output redirection | CO2 |
| 7 | Use of pipes for combining commands | CO2 |
| 8 | Writing simple shell scripts (addition, factorial, palindrome) | CO3 |

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|-------------|----------|-------------|------------------------------|-------------------------|---------------|----------------------|-------------------------|----------------------|---|---|---|---------|--|
| | | | Marks | THEORY | | | PRACTICAL | | | | | | |
| | | | | END SEM University Exam | Two Term Exam | Teachers Assessment* | END SEM University Exam | Teachers Assessment* | | | | | |
| DTCS305 | SEC | Unix Lab | Max | 0 | 0 | 0 | 30 | 20 | 0 | 0 | 2 | 1 | |
| | | | Min | 0 | 0 | 14 | 9 | | | | | | |

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| | | |
|----|---|-----|
| 9 | Programs using conditional statements (if, if-else, case) | CO3 |
| 10 | Programs using loops (for, while, until) | CO3 |
| 11 | Shell scripts using functions and command-line arguments | CO3 |
| 12 | Process management using ps, kill, top | CO4 |
| 13 | Disk usage analysis using df and du commands | CO4 |

COURSE ARTICULATION MATRIX (MAPPING OF COs WITH POs)

| Course Outcomes | Correlation with POs | | | | | | | | | | | | Correlation with PSOs | | |
|-----------------|----------------------|------|------|------|------|------|------|------|------|-------|-------|-------|-----------------------|-------|-------|
| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
| CO1 | 3 | 2 | 1 | 1 | 3 | - | - | - | 1 | 1 | - | 2 | 2 | 1 | 1 |
| CO2 | 3 | 3 | 2 | 2 | 3 | 2 | - | 1 | 2 | 2 | 1 | 2 | 3 | 2 | 2 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 2 | 3 | 2 | 2 | 3 | 3 | 2 | 3 |
| CO4 | 3 | 3 | 3 | 2 | 3 | 3 | 1 | 1 | 3 | 2 | 1 | 3 | 3 | 3 | 3 |

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|-------------|----------|-----------------------|------------------------------|--------------------|---------------|----------|-------------------------|----------------------|---|---|---|---------|
| | | | Marks | THEORY | | | PRACTICAL | | | | | |
| | | | | END SEM University | Two Term Exam | Teachers | END SEM University Exam | Teachers Assessment* | | | | |
| DTCS306 | SEC | Computer Hardware Lab | Max | 00 | 00 | 00 | 00 | 50 | 0 | 0 | 2 | 1 |
| | | | Min | 00 | 00 | 00 | 00 | 23 | | | | |

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

COURSE OBJECTIVES:

The student will have the ability to:

1. To familiarize students with basic computer hardware components and their functions.
2. To develop skills in assembling, disassembling, and handling computer systems safely.
3. To provide practical knowledge of installing processors, memory, storage devices, and peripherals.
4. To introduce BIOS/UEFI configuration and driver installation processes.
5. To enable students to perform basic troubleshooting, maintenance, and system protection.

Course Alignment with UNSDG:

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|-------------|----------|-----------------------|------------------------------|--------------------|---------------|----------|-------------------------|----------------------|---|---|---|---------|
| | | | Marks | THEORY | | | PRACTICAL | | | | | |
| | | | | END SEM University | Two Term Exam | Teachers | END SEM University Exam | Teachers Assessment* | | | | |
| DTCS306 | SEC | Computer Hardware Lab | Max | 00 | 00 | 00 | 00 | 50 | 0 | 0 | 2 | 1 |
| | | | Min | 00 | 00 | 00 | 00 | 23 | | | | |

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

The Course aims to fulfill the United Nations Sustainable Development Goals, **SDG 4 (Quality Education)**.

Course outcomes: After completion of the course, the student will be able to:

| | |
|------|--|
| CO-1 | Identify and describe various computer hardware components and tools used in a hardware lab. |
| CO-2 | Assemble and configure a computer system that includes a CPU, RAM, and storage devices. |
| CO-3 | Install operating system support components, such as drivers and peripheral device support. |
| CO-4 | Diagnose and troubleshoot common hardware and boot-related issues. |
| CO-5 | Perform preventive maintenance, basic system protection, and data backup operations. |

Teaching Pedagogy:

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|-------------|----------|-----------------------|------------------------------|--------------------|---------------|----------|-------------------------|----------------------|---|---|---|---------|
| | | | Marks | THEORY | | | PRACTICAL | | | | | |
| | | | | END SEM University | Two Term Exam | Teachers | END SEM University Exam | Teachers Assessment* | | | | |
| DTCS306 | SEC | Computer Hardware Lab | Max | 00 | 00 | 00 | 00 | 50 | 0 | 0 | 2 | 1 |
| | | | Min | 00 | 00 | 00 | 00 | 23 | | | | |

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

| | |
|-----------|---|
| T1 | Classroom teaching (white board), Power Point Presentations, Interactive lectures, Inquiry-based teaching |
| T2 | ABL activities, Assignments, Flip Class/ Seminars, Quizzes, Oral Viva-voce examination |

Assessment Tools

| | |
|--------------|-------------------------|
| AT1-1 | Quiz |
| AT1-2 | Activity-Based Learning |
| AT1-3 | Flip Class |
| AT1-4 | Seminar Presentation |
| AT1-5 | Assignments |

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|-------------|----------|-----------------------|------------------------------|--------------------|---------------|----------|-------------------------|----------------------|---|---|---|---------|
| | | | Marks | THEORY | | | PRACTICAL | | | | | |
| | | | | END SEM University | Two Term Exam | Teachers | END SEM University Exam | Teachers Assessment* | | | | |
| DTCS306 | SEC | Computer Hardware Lab | Max | 00 | 00 | 00 | 00 | 50 | 0 | 0 | 2 | 1 |
| | | | Min | 00 | 00 | 00 | 00 | 23 | | | | |

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

| | |
|-------|----------------------------|
| AT1-6 | Poster |
| AT1-7 | Oral Viva-voce examination |
| AT1-8 | Industrial Visit Report |

Prerequisites: Basic knowledge of computers – understanding of what a computer is and its general uses. Familiarity with operating systems – basic use of systems like Microsoft Windows or Linux.

| Module | Descriptors/Topics | Hours | Assessment tools |
|--------|---|-------|------------------|
| I | Introduction to Computer Hardware & Safety: Identification of hardware components (CPU, motherboard, RAM, SMPS, HDD/SSD, peripherals), Tools used in the hardware lab (screwdrivers, anti-static wrist strap, multimeter) | 6 | T1,T6 |

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|-------------|----------|-----------------------|------------------------------|--------------------|---------------|----------|-------------------------|----------------------|---|---|---|---------|
| | | | Marks | THEORY | | | PRACTICAL | | | | | |
| | | | | END SEM University | Two Term Exam | Teachers | END SEM University Exam | Teachers Assessment* | | | | |
| DTCS306 | SEC | Computer Hardware Lab | Max | 00 | 00 | 00 | 00 | 50 | 0 | 0 | 2 | 1 |
| | | | Min | 00 | 00 | 00 | 00 | 23 | | | | |

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;
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| | | | |
|------------|---|---|-------|
| | Lab safety practices and ESD (Electrostatic Discharge) precautions, Opening and assembling a desktop computer system, Understanding different types of cabinets (ATX, Micro-ATX) | | |
| II | Motherboard, Processor & Memory Installation: Study of motherboard layout and components. Installing and removing CPU (Intel/AMD basics), applying thermal paste and fixing heat sink/fan, installing RAM modules (DDR types overview), BIOS/UEFI basics, and navigation. | 6 | T1,T6 |
| III | Storage Devices & Power Supply: Types of storage devices (HDD, SSD, NVMe), SATA and power cable connections, Partitioning and formatting basics, SMPS (power supply) functions and connectors, Power troubleshooting basics. | 6 | T1,T6 |
| IV | Peripheral Devices & Driver Installation: Installation of peripherals (keyboard, mouse, monitor, printer), | | |

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|-------------|----------|-----------------------|------------------------------|--------------------|---------------|----------|-------------------------|----------------------|---|---|---|---------|
| | | | Marks | THEORY | | | PRACTICAL | | | | | |
| | | | | END SEM University | Two Term Exam | Teachers | END SEM University Exam | Teachers Assessment* | | | | |
| DTCS306 | SEC | Computer Hardware Lab | Max | 00 | 00 | 00 | 00 | 50 | 0 | 0 | 2 | 1 |
| | | | Min | 00 | 00 | 00 | 00 | 23 | | | | |

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;
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| | | | |
|----------|--|-----------|-------|
| | Understanding ports (USB, HDMI, VGA, Ethernet), Device drivers: concept and installation, Introduction to plug-and-play devices, Basic troubleshooting of peripherals. | 6 | T1,T6 |
| V | Basic Troubleshooting & Maintenance: Common hardware problems and solutions, POST (Power-On Self-Test) and beep codes, Cleaning and preventive maintenance, Virus/malware basics and system protection, Introduction to backup and recovery. | 6 | T1,T6 |
| | Total Hours | 30 | |

Additional Resources

A. Value addition to course content/ Skill enhancement content:

https://onlinecourses.swayam2.ac.in/nou25_ma10/preview

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B. Remedial classes for slow learners: As per the SVVV SOP for slow and fast learners.

Suggested Readings:

| | |
|-------------------------|--|
| Text Books: | |
| 1. | <i>K. Sinha and Priti Sinha, Computer Fundamentals, 7th Edition, BPB Publications, 2021.</i> |
| 2. | <i>V. Rajaraman, Fundamentals of Computers, 6th Edition, PHI Learning, 2014.</i> |
| 3. | <i>M. Morris Mano, Computer System Architecture, 3rd Edition, Pearson Education, 2007.</i> |
| Reference Books: | |
| 1. | <i>Carl Hamacher, Zvonko Vranesic, Safwat Zaky, and Naraig Manjikian, Computer</i> |

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| | |
|----|--|
| | <i>Organization and Embedded Systems, 6th Edition, McGraw-Hill Education, 2017.</i> |
| 2. | <i>William Stallings, Computer Organization and Architecture: Designing for Performance, 11th Edition, Pearson Education, 2019.</i> |
| 3. | <i>David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, 5th Edition, Morgan Kaufmann, 2014.</i> |

Practical List:

| Practical No. | Practical Title | CO Mapping |
|---------------|--|------------|
| 1 | Identify internal hardware components of a desktop system (CPU, motherboard, RAM, SMPS, storage devices) | CO1 |
| 2 | Demonstrate safe handling of computer hardware using anti-static precautions and lab safety tools | CO1 |

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| | | |
|----|---|----------|
| 3 | Disassemble a desktop computer and study different hardware parts | CO1 |
| 4 | Assemble a desktop computer system by connecting motherboard, CPU, RAM, and storage devices | CO2 |
| 5 | Install CPU on motherboard and apply thermal paste with heat sink/fan mounting | CO2 |
| 6 | Install and remove RAM modules and verify system boot using BIOS/UEFI | CO2 |
| 7 | Connect and configure storage devices (HDD/SSD) and perform partitioning and formatting | CO2, CO3 |
| 8 | Install and configure peripheral devices such as keyboard, mouse, monitor, and printer | CO3 |
| 9 | Install and update device drivers for various hardware components and troubleshoot issues | CO3, CO4 |
| 10 | Perform basic system troubleshooting, cleaning, maintenance, and | CO4, CO5 |

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| | | |
|--|-------------------------------------|--|
| | observe POST/beep codes during boot | |
|--|-------------------------------------|--|

COURSE ARTICULATION MATRIX (MAPPING OF COs WITH POs)

| Course Outcomes | Correlation with POs | | | | | | | | | | | | Correlation with PSOs | | |
|-----------------|----------------------|------|------|------|------|------|------|------|------|-------|-------|-------|-----------------------|-------|-------|
| | P O1 | P O2 | P O3 | P O4 | P O5 | P O6 | P O7 | P O8 | P O9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
| CO1 | 3 | 2 | – | – | 2 | – | – | – | – | – | – | 1 | 3 | 1 | 1 |
| CO2 | 3 | 3 | 3 | 1 | 3 | – | – | – | 1 | – | – | 1 | 3 | 2 | 2 |
| CO3 | 3 | 2 | 3 | 1 | 3 | – | – | – | 1 | 1 | – | 1 | 2 | 3 | 2 |
| CO4 | 3 | 3 | 2 | 3 | 3 | – | – | – | 1 | 1 | – | 2 | 2 | 3 | 3 |
| CO5 | 2 | 2 | 1 | 2 | 2 | – | 1 | – | – | – | – | 3 | 1 | 2 | 3 |

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