

**Department of Software Engineering (SE)**

**Faculty of Science and Information Technology (FSIT)**

**Daffodil International University (DIU)**

**(Version 2.1)**

| **Course Code:** SE 233 | | | **CIE Marks:** 60 |
| --- | --- | --- | --- |
| **ISCED:** 0613-233 | | | **LF Marks:** 40 |
| **Course Title:** Operating System & System Programming Lab | | | **Total Marks:** 100 |
| **Semester:** | | | |
| **Credit:** 1 (Lab) | | **Contact Hours:** 1 hour 30 minutes (14 weeks) | |
| **Prerequisite:** SE 222 | | | |
| **Course Type:** Lab | | | |

CIE: Continuous Internal Evaluation

LF: Lab Final

**Instructor Details**

| **Name:** |  |
| --- | --- |
| **Employee ID:** |  |
| **Designation:** |  |
| **Department:** |  |
| **Office Address:** |  |
| **Telephone/Extension:** |  |
| **Mobile:** |  |
| **Website:** |  |
| **GTA/UTA(If Any):** |  |

**Class Schedule with Counseling Hour**

| **Time/**  **Date** | **8:30 AM-**  **9:45 AM** | **9:45 AM-**  **11:00 AM** | **11:00 AM-**  **12:15 PM** | **12:15 PM-**  **1:30 PM** | **1:30 PM-**  **2:45 PM** | **2:45 PM-**  **4:00 PM** | **4:00 PM-**  **5:15 PM** | **5:15 PM-**  **6:30 PM** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Saturday** |  |  |  |  |  |  |  |  |
| **Sunday** |  |  |  |  |  |  |  |  |
| **Monday** |  |  |  |  |  |  |  |  |
| **Tuesday** |  |  |  |  |  |  |  |  |
| **Wednesday** |  |  |  |  |  |  |  |  |
| **Thursday** |  |  |  |  |  |  |  |  |

**Course Content (from syllabus)**

This course introduces the tools used to develop modern operating systems (OS). The focus of this course is UNIX-based operating systems, though alternative operating systems, including MS Windows are introduced. This course is divided into two parts. The first part is about the GNU/Linux command line interface to operate basic operations

The second parts are about the GNU/Linux application programming interface. In this part the creation and control of processes and threads are practiced. The cooperative process resource share management system and some advanced topics in the field of process scheduling, concurrency (synchronization, mutual exclusion, deadlock, and starvation), memory (both primary and secondary) management and input/output file organization are practiced.

**Rationale of the Course**

The “Operating System & System Programming” course offers a comprehensive exploration of the tools and concepts necessary for crafting contemporary operating systems, with a particular emphasis on UNIX-based platforms such as GNU/Linux. Structured into two distinct segments, the initial portion delves into mastering the GNU/Linux command line interface, fostering adeptness in system navigation and management. The subsequent segment focuses on the GNU/Linux application programming interface, where students engage in hands-on exercises to grasp the intricacies of process and thread creation, as well as their control mechanisms. Through practical applications, students gain proficiency in cooperative process resource management, process scheduling, concurrency, memory management, and input/output file organization. Advanced topics including synchronization, mutual exclusion, deadlock, and starvation are explored, equipping students with a comprehensive understanding of operating system dynamics, thereby readying them for careers in software development, system administration, and related domains.

**Course Objectives**

The goal of this course is to introduce the students to the concept of command based UNIX operating system in practical terms. The main objectives of this course are,

* To operate the UNIX command line to explore open-source software under GNU/Linux Operating System.
* To write basic code on Shell Script and controlling processes and threads in Modern OS. Write code for handling process concurrency mechanisms such as Mutual Exclusion, Synchronization, Deadlock and Starvation using semaphore (GNU/Linux POSIX API).
* To implement Algorithm implementation using shell scripting programming.

**Course Learning Outcomes (CLOs) with Mappings**

At the end of the course, students will be able to:

| **CLOs** | **CLO Descriptions** | **Program Learning Outcomes (PLOs)** | **Learning Domains (C, P, A)** | **BNQF Skill** |
| --- | --- | --- | --- | --- |
| CLO1 | **Interpret** the GNU/Linux GUI and command line interface. | PLO5 | C3 | Fundamental Domain |
| CLO2 | **Demonstrate** the file Handling in GNU/Linux, Programming with Shell Scripting. | PLO3 | C3, P3 | Fundamental Domain |
| CLO3 | **Implement** technical aspects of modern operating systems. | PLO3 | C4, P2 | Fundamental Domain |
| CLO4 | **Write** an effective report on the technical solutions of modern operating systems. | PLO10 | A3 | Social Domain, Thinking Domain, Personal Domain |

**Mapping of CLOs with PLOs**

| **Course Learning Outcome** | **PLO1** | **PLO2** | **PLO3** | **PLO4** | **PLO5** | **PLO6** | **PLO7** | **PLO8** | **PLO9** | **PLO10** | **PLO11** | **PLO12** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CLO1** |  |  |  |  | **√** |  |  |  |  |  |  |  |
| **CLO2** |  |  | **√** |  |  |  |  |  |  |  |  |  |
| **CLO3** |  |  | **√** |  |  |  |  |  |  |  |  |  |
| **CLO4** |  |  |  |  |  |  |  |  |  | **√** |  |  |

**Course plan specifying content, CLOs, co-curricular activities (if any), teaching learning and assessment strategy mapped with CLOs:**

| **Week/**  **Lesson (hour)** | **Lesson Topic** | **Teaching Learning Strategy** | **Corresponding CLOs** | **Assessment Strategy** |
| --- | --- | --- | --- | --- |
| Week-1 [1.5 Hours] | Discussion on OBE of Operating System & System Program Lab & Introduction to Linux Operating system | Classroom discussion, Voice over PPT, Lecture video, Lecture notes, Open discussion | CLO1 | Lab Performance |
| Week-2  [1.5 Hours] | Installation: Linux Installation using Virtual Machine Platform | Classroom discussion, Voice over PPT, Lecture video, Lecture notes, Open discussion. | CLO1 | Lab Performance |
| Week-5  [1.5 Hours] | Windows Vs Linux: Type of files, directories, users | Classroom discussion, Lecture video, Lecture notes, Open discussion | CLO1, CLO4 | Lab Performance |
| Week-4  [1.5 Hours] | Commands Terminal V/s GUI  File Commands (ls, cd, pwd, mkdir, cp, mv, rm, rmdir, cat, more, less, touch, head, tail, ls) | Problem solving in the Linux/Ubuntu operating system | CLO1, CLO4 | Lab Performance,Viva, Lab Final |
| Week-5  [1.5 Hours] | File Permissions (chmod), File Redirection (>, >>), vi Editor, nano editor and their functionalities | Problem solving in the Problem solving in the Linux/Ubuntu operating system | CLO1, CLO4 | Lab Performance,Viva, Lab Final |
| Week-6  [1.5 Hours] | Searching (grep, locate, find)  System Information (date, cal, w, whoami, finger, uname, cat /proc/cpuinfo) | Problem solving in the Linux/Ubuntu operating system | CLO1, CLO4 | Lab Performance,Viva, Lab Final |
| Week-7  [1.5 Hours] | System Information (cat proc/meminfo, man, df, du, free, whereis App, which app) | Problem solving in the Linux/Ubuntu operating system | CLO1, CLO4 | Lab Performance, Viva, Lab Final |
| Week-8  [1.5 Hours] | Unix Administration (Creating a User, Deleting, disabling account, Adding users to the user groups, Finger, Linux/Unix User Management Commands | Problem solving in the Linux/Ubuntu operating system | CLO1, CLO4 | Viva, Lab Final |
| Week-9  [1.5 Hours] | Basic of Shell Scripting | Classroom discussion, Open discussion, Problem solving in the lab with Linux/Ubuntu operating system | CLO2, CLO3 | Lab Performance |
| Week-10  [1.5 Hours] | Implement Conditional statement in shell scripting. | Problem solving in the Linux/Ubuntu operating system. | CLO2, CLO3, CLO4 | Lab Performance, Viva, Lab Final |
| Week-11  [1.5 Hours] | Implement Loop in shell scripting and Implementation of the scheduling algorithm. | Problem solving in the Linux/Ubuntu operating system. | CLO2, CLO3, CLO4 | Lab Performance, Viva, Lab Final |
| Week-12  [1.5 Hours] | File Handling in GNU/Linux, Programming with Pipes, Sockets Programming. | Classroom discussion, Open discussion, Problem solving in the lab with Linux/Ubuntu operating system. | CLO2, CLO3, CLO4 | Lab Performance |
| Week-13  [1.5 Hours] | Industry Session. | Interactive Lectures and Presentations, Expert Talks, Hands-On Workshops, Site Visits and  Virtual Tours | CLO1, CLO2, CLO3, CLO4 | Lab Performance, Presentation |
| Week-14  [1.5 Hours] | Lab Final | Problem solving in the lab with Linux/Ubuntu operating system. | CLO1, CLO2, CLO3, CLO4 | Viva, Lab Final |

**Overall Assessment Scheme & Marks Distribution**

| **Assessment Task** | **Assigned Mark** | **CLO’s** | **PLO’s** |
| --- | --- | --- | --- |
| Attendance | 10 |  |  |
| Lab Report | 25 | CLO4 | PLO10 |
| Lab Performance | 25 | CLO3 | PLO3 |
| Lab Final | 40 | CLO1 | PLO5 |
| CLO2 | PLO3 |
| **Total** | **100** |  |  |

**Evaluation Policy (Grading Policy)                                                                                                      :**

| **Marks obtained out of 100** | **Grade** | **Grade point equivalent** | **Remarks** |
| --- | --- | --- | --- |
| 80% and above | A+ | 4.00 | Outstanding |
| 75% to less than 80% | A | 3.75 | Excellent |
| 70% to less than 75% | A- | 3.50 | Very Good |
| 65% to less than 70% | B+ | 3.25 | Good |
| 60% to less than 65% | B | 3.00 | Satisfactory |
| 55% to less than 60% | B- | 2.75 | Above Average |
| 50% to less than 55% | C+ | 2.50 | Average |
| 45% to less than 50% | C | 2.25 | Below Average |
| 40% to less than 45% | D | 2.00 | Pass |
| Less than 40% | F | 0.00 | Fail |

**Class Make-up Procedure**

Missed class will be taken at convenient free class hours following the procedure of the university.

**Notional Hour**

|  | Credits | Notional Hour  ( Guided by BNQF ) | Face to Face/ Class Time | STL, Preparatory  time etc. |
| --- | --- | --- | --- | --- |
| Theory | 12 | 12\*40= 480 Hours | **For 1 theory course (3 credit)**  3 Hour/week \* 14 week=42 hours  **For 4 theory courses (3\*4 credit)**  42\*4=168 hours | Around 4.64 hours. |
| Lab | 2 | 2\*60=120 Hours | **For 1 lab course (1 credit)**  1.5 Hour/week \* 14 week=21 hours  **For 2 lab course (1\*2 credit)**  21\*2=42 hours |
| Total | 14 | 600 Hours | 210 hours |

**Textbook/Recommended Readings**

Richard Blum, Christine Bresnahan, Linux Command Line and Shell Scripting Bible, 4th Edition, Wiley, 2021, ISBN: 978-1118983843.

**Reference Books/ Other Supplementary Readings**

1. William Stallings, Operating Systems: Internals and Design Principles, 9th Edition, Pearson, 2015, ISBN: 978-0134670959.
2. Lab Manual

**Course Materials and Slides**

All course materials and slides will be available in DIU Blended Learning Center, and Google Classroom. (Everyone is requested to join google classroom and BLC account).

**Software/Tools used**

Virtual Box, Online Script Compiler

**Exam Dates**

According to the Examination Schedule

**Academic Code of Conduct**

**Academic Integrity:**

Academic offenses under the Academic Code of Conduct include plagiarism, personification, physical and online cheating, falsification of a document, and any other dishonest behavior related to gaining academic gain or avoiding evaluation exercises by a student. The university's Disciplinary Committee may decide to impose severe penalties for these offenses.

**Special Instructions:**

* The tutorial class will be held in accordance with the department's guidelines.
* Attendance at all classes and exams is required of the students. To take the final test, a student needs to have attended at least 70% of classes.
* After ten minutes of the scheduled start time, students will not be permitted to enter the classroom.
* Plagiarism will automatically result in a zero on that exam or assignment.
* There won't often be a make-up exam. However, if a student misses an exam due to a serious sickness, the death of a family member, an emergency involving the family, or humanitarian reasons, they MUST request permission to make up the exam in writing through the course instructor to the chairperson within 48 hours of the exam date. The application must be submitted with the appropriate supporting documentation for the reason(s) for the absence from the exam.
* There won't be a makeup exam for the final exam. However, if a student is unable to attend the final exam due to a serious illness, a family member's death, an emergency, or humanitarian reasons, they MUST request an incomplete grade in writing from the course instructor via the chairperson within 48 hours of the exam date. Along with the application, appropriate supporting documentation for the reason(s) for missing the final exam must be provided. It is the student's duty, in consultation with the course instructor, to schedule an incomplete exam by the deadline specified in the academic calendar.
* It is required that all cell phones be in silent mode during class and test times.
* Exam cheating is not tolerated at all. Examinees will be penalized for cheating if they are found in possession of cheat sheets, used or not; if they write on their palms, the backs of calculators, chairs, or adjacent walls; if they copy from cheat sheets or other sources; if they copy from other examiners, etc. Cheating only carries a single, multi-semester expulsion, as determined by the university's disciplinary committee.

**Appendix**

**Program Learning Outcomes (PLOs)**

| **No.** | **Program Learning Outcomes** |
| --- | --- |
| PLO1 | Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems. |
| PLO2 | Identify, formulate, research and analyze complex engineering problems and reach substantiated conclusions using the principles of mathematics, the natural sciences and the engineering sciences. |
| PLO3 | Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety and of cultural, societal and environmental concerns. |
| PLO4 | Conduct investigations of complex problems, considering experimental design, data analysis and interpretation and information synthesis to provide valid conclusions. |
| PLO5 | Create, select and apply appropriate techniques, resources and modern engineering and IT tools, including prediction and modeling, to complex engineering activities with an understanding of their limitations. |
| PLO6 | Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice. |
| PLO7 | Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development. |
| PLO8 | Apply ethical principles and commit to the professional ethics, responsibilities and the norms of the engineering practice. |
| PLO9 | Function effectively as an individual and as a member or leader of diverse teams and in multidisciplinary settings. |
| PLO10 | Communicate effectively about complex engineering activities with the engineering community and with society at large. Be able to comprehend and write effective reports, design documentation, make effective presentations and give and receive clear instructions. |
| PLO11 | Demonstrate knowledge and understanding of engineering and management principles and apply these to one’s work as a team member or a leader to manage projects in multidisciplinary environments. |
| PLO12 | Recognize the need for and have the preparation and ability to engage in independent, life-long learning in the broadest context of technological change. |

**Learning Domain (Bloom’s taxonomy)**

1. **Cognitive Domain (Knowledge):** The cognitive domain aims to develop the mental skills and the acquisition of knowledge of the individual.

| **Domain Level** | **Definition** |
| --- | --- |
| Remember (C1) | Retrieving, recalling, or recognizing information from memory. |
| Understand(C2) | Changing from one form of representation to another; illustrating a concept; drawing conclusions; determining cause and effect |
| Apply(C3) | Using learned materials, students can use/apply information in a new way. |
| Analyze(C4) | Breaking material or concepts into parts, determining how the parts related or interrelated to one another or to an overall structure or purpose. |
| Evaluate(C5) | Assessing, making judgments and drawing conclusions from ideas, information, or data. |
| Create(C6) | Developing a hypothesis; devising a procedure; inventing a product |

1. **Affective Domain (Attitude):** The affective domain includes how learners deal with things emotionally, such as feelings, values, appreciation, enthusiasms, motivations, and attitudes.

| **Domain Level** | **Definition:** |
| --- | --- |
| Receiving (A1) | Being aware of or attending to something in the environment. |
| Responding(A2) | Showing some new behaviors as a result of experience. |
| Valuing(A3) | Showing some definite involvement or commitment. |
| Organization(A4) | Integrating a new value into one's general set of values, giving it some   ranking among one's general priorities. |
| Characterization by value(A5) | Acting consistently with the new value. |

1. **Psychomotor Domain (skill):** Includes physical movement, coordination, and use of the motor-skill areas.

| **Domain Level** | **Definition:** |
| --- | --- |
| Imitating (P1) | Attempted copying of a physical behavior |
| Manipulation(P2) | Reproducing activity from instruction or memory |
| Precision(P3) | Fine tuning. Making minor adjustments in the physical activity in order to perfect it. |
| Articulation(P4) | Adapting and integrating expertise to satisfy a non- standard objective |
| Naturalization(P5) | Automated, unconscious mastery of activity and related skills at strategic level |

**BNQF Skills (4 year’s Bachelors):**

The Learning Outcome Domains are Fundamental Domain, Social Domain, Thinking Domain and Personal Domain. These domains are classified below.

**Fundamental Skills:**

* Demonstrate knowledge and critical understanding of the well-established principles of his/her field of study, and of the way in which those principles have developed.
* Apply underlying concepts and principles outside the context in which they were first studied, including, where appropriate, the application of those principles in an employment context.
* Apply knowledge and skills in addressing issues/solving problems with minimal supervision.
* Evaluate critically the appropriateness of different approaches to solving problems in his/her field of study.
* Support supervision of junior staff via a mentor or a leader/manager.
* Display advanced digital literacy which is adequate to perform complex tasks and bring about solutions.

**Social Skills:**

* Communicate and interact effectively and clearly, ideas, information, problems and solutions as a team to peers, experts and non-experts in Bangla and English.
* Express her/himself fluently and spontaneously in English and Bangla.
* Use language flexibly and effectively for social, academic and professional purposes.
* Produce clear, well structured, detailed text on complex subjects, showing controlled use of organizational patterns, connectors and cohesive devices in advanced proficiency level of Bangla and English.
* Demonstrate the ability to incorporate entrepreneurial skills in planning daily activities.
* Display advanced civic literacy and knowledge, exercising civic rights and obligations at all levels as well as participating in changes for the improvement of Bangladesh society.

**Thinking Skills**:

* Exercise very substantial degree of autonomy and often significant responsibility in making
* Judgments / decisions towards the management of self, others and for the allocation of substantial resources.
* Demonstrate professional knowledge and practical skills in both technical and management to lead a team in an inexperienced environment.

**Personal Skills:**

* Engage in self-direction and self-enterprise skills.
* Demonstrate social, professional, environmental and ethical practice/ values.
* Show-case global knowledge and competencies to fulfill employment, entrepreneurial and lifelong learning skills; and contribute significantly to the society.