

**Department of Software Engineering (SE) Faculty of Science and Information Technology (FSIT)**

**Daffodil International University (DIU) (Version 2.1)**

| **Course Code:** SE 232 | | | **CIE Marks:** 60 |
| --- | --- | --- | --- |
| **ISCED:** 0613-232 | | | **SEE Marks:** 40 |
| **Course Title:** Operating System and System Program | | | **Total Marks:** 100 |
| **Semester:** | | | |
| **Credit Value:** 3 (Theory) | | **Contact Hours:** 3 (Total weeks: 14) | |
| **Prerequisite:** SE 222 | | | |
| **Course Type:** Core | | | |

CIE: Continuous Internal Evaluation SEE: Semester End Examination

**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 modern operating systems. It focuses on UNIX-based operating systems, though alternative operating systems, including Windows, are introduced. This course is beginning with an overview of the structure of modern operating systems. Throughout the subsequent units, discuss the history of modern computers, analyze in detail each of the major components of an operating system (from processes to threads), and explore more advanced topics in the field, including concurrency (synchronization, mutual exclusion, deadlock, starvation), memory (both primary and secondary) management and input/output file management and organization (segmentation, paging, swapping), file systems, and operating system support for distributed systems. Different CPU scheduling algorithms and disk scheduling algorithms have also been discussed in detail.

**Rationale of the Course**

The course is designed to provide students with a comprehensive understanding of a crucial abstraction layer between hardware and application software. This abstraction simplifies the complexity of hardware interaction, enabling programmers to focus on developing applications without dealing with intricate hardware details. Understanding how operating systems manage resources, such as CPU, memory, and peripherals, is vital. This knowledge allows students to comprehend how multiple processes coexist, share resources, and execute concurrently, contributing to the efficient utilization of computing resources and also learn about the CPU Scheduling algorithms for better resource management.

Operating systems deal with challenges related to concurrency, where multiple processes or threads are executing simultaneously. Students learn about synchronization mechanisms to manage shared resources, preventing issues like data corruption or conflicts.

The course covers memory allocation and de-allocation strategies, exploring how operating systems ensure efficient usage of memory. Concepts like virtual memory and paging are introduced, emphasizing the role of the operating system in managing limited physical resources effectively. Students also gain knowledge about the organization and management of file systems, understanding how data is stored, retrieved, and organized on storage devices. This knowledge is essential for developing applications that interact with files and directories.

**Course Objectives**

To provide a solid conceptual understanding of the fundamentals of Software Engineering. More specifically,

* To explore the processes and threads roles, states, components, scheduling, and concurrency of the modern operating system.
* To demonstrate the process scheduler.
* To explain and analyze the concurrency problem including synchronization, mutual exclusion, deadlock and starvation.
* To explain and solve problems on memory management (primary and secondary) and virtual memory management systems and file management systems.

**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 | **Identify** the basic functions and principles of operating systems. | PLO2 | C1 | Fundamental Domain |
| CLO2 | **Apply** different algorithms for the solution of major components of operating systems | PLO1 | C3 | Fundamental Domain |
| CLO3 | **Analyze** the performance of control manager, memory manager, I/O manager, and file manager | PLO2 | C4 | Fundamental Domain |
| CLO4 | **Evaluate** the best technique for a specific problem related to the function of the operating system. | PLO2 | C5 | Fundamental 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** | **Assessment Strategy** | **Corresponding CLOs** |
| --- | --- | --- | --- | --- |
| Week-1  Lesson 1 & 2 [3 Hours] | Lesson 1: Discussion on OBE of Course outline, CLO-PLO mapping | Classroom discussion, Open discussion. | N/A | CLO1 |
| Lesson 2: Operating System Overview Operating System Objectives and Functions. Characteristics of modern Operating System, The evolution of Operating System | Classroom discussion, Voice over PPT, Lecture video, Lecture notes, Open discussion. | Class Test,  Midterm exam | CLO1 |
| Week-2  Lesson 1 & 2 [3 Hours] | Lesson 1: Operating System Structure | Classroom discussion, Voice over PPT, Lecture video, Lecture notes, Open discussion. | Class Test,  Midterm exam | CLO1, CLO2 |
| Lesson 2: Different types of Operating System with their importance. | Classroom discussion, Voice over PPT, Lecture notes, Open discussion.. | Class Test,  Midterm exam | CLO1 |
| Week-3  Lesson 1 & 2 [3 Hours] | Lesson 1: Process Description and Control. Process concept and state. | Classroom discussion, Voice over PPT, Lecture notes, Open discussion. | Class Test,  Midterm exam | CLO1, CLO2 |
| Lesson 2: Process Description Process Control  UNIX FreeBSD Process Management | Classroom discussion, Voice over PPT, Lecture video, Lecture notes, Open discussion.. | Class Test,  Midterm exam | CLO1, CLO2 |
| Week-4  Lesson 1 & 2 [3 Hours] | Lesson 1: Threads, SMP, and Microkernels  Processes and Threads  Symmetric Multiprocessing (SMP). | Classroom discussion, Voice over PPT, Lecture video, Lecture notes | Class Test,  Midterm exam | CLO1, CLO2 |
| Lesson 2: Microkernels  Windows Vista Thread and SMP Management  Linux Process and Thread Management  **Class Test -1** | Classroom discussion, Voice over PPT, Lecture video, Lecture notes, Open discussion. | Class Test,  Midterm exam | CLO1, CLO2 |
| Week-5  Lesson 1 & 2 [3 Hours] | Lesson 1: Uniprocessor Scheduling  Scheduling Algorithms | Brainstorming Session, Classroom discussion, Voice over PPT, Lecture video, Lecture notes, Open Discussion. | Class Test,  Assignment,  Midterm exam | CLO2 |
| Lesson 2: Scheduling Algorithms | Brainstorming Session, Classroom discussion, Voice over PPT, Lecture video, Lecture notes, Open Discussion. summaries, and open exchanges of ideas. | Class Test,  Assignment,  Midterm exam | CLO2 |
| Week-6  Lesson 1 & 2 [3 Hours] | Lesson 1: Concurrency: Mutual Exclusion and Synchronization | Classroom discussions, Voice over PPT, Lecture video, Lecture note. | Final exam | CLO3 |
| Lesson 2: Principles of Concurrency, Mutual Exclusion: Hardware Support  **Class Test -2** | Classroom discussions, Voice over PPT, Lecture video, Lecture note. | Final exam | CLO3 |
| Week-7  Lesson 1 & 2 [3 Hours] | Lesson 1: Semaphore, Monitors | Classroom discussions, Voice over PPT, Lecture video, Lecture note. | Final exam | CLO2, CLO3 |
| Lesson 2: Message Passing Readers/Writers Problem | Classroom discussions, Voice over PPT, Lecture video, Lecture note. | Final exam | CLO2, CLO3 |
| Week-8  Lesson 1 & 2 [3 Hours] | Lesson 1: Concurrency: Deadlock and Starvation  Principles of Deadlock | Brainstorming Session, Classroom discussion, Voice over PPT, Lecture video, Lecture notes, Open Discussion. | Class Test,  Final exam | CLO2, CLO3 |
| Lesson 2: Deadlock Prevention Deadlock Avoidance | Brainstorming Session, Classroom discussion, Voice over PPT, Lecture video, Lecture notes, Open Discussion. | Class Test,  Final exam | CLO2, CLO3 |
| Week-9  Lesson 1 & 2 [3 Hours] | Lesson 1: Deadlock Detection  An Integrated Deadlock Strategy | Brainstorming Session, Classroom discussion, Voice over PPT, Lecture video, Lecture notes, Open Discussion. | Class Test,  Final exam | CLO2, CLO3 |
| Lesson 2: Dining Philosophers Problem  UNIX Concurrency Mechanisms  Linux Kernel Concurrency Mechanisms | Brainstorming Session, Classroom discussion, Voice over PPT, Lecture video, Lecture notes, Open Discussion. | Class Test,  Final exam | CLO2, CLO3 |
| Week-10  Lesson 1 & 2 [3 Hours] | Lesson 1: Memory Management  Memory Management Requirements | Classroom discussions, Voice over PPT, Lecture video, Lecture note, Open discussion | Presentation,  Final exam | CLO4 |
| Lesson 2: Memory Partitioning, Paging Segmentation | Classroom discussions, Voice over PPT, Lecture video, Lecture note, Open discussion | Presentation,  Final exam | CLO4 |
| Week-11  Lesson 1 & 2 [3 Hours] | Lesson 1: Virtual Memory  Hardware and Control Structures | Classroom discussions, Voice over PPT, Lecture video, Lecture note, Open discussion | Presentation,  Final exam | CLO4 |
| Lesson 2: Operating System Software  Linux Memory Management  **Class Test -3** | Classroom discussions, Voice over PPT, Lecture video, Lecture note, Open discussion | Presentation,  Final exam | CLO4 |
| Week-12  Lesson 1 & 2 [3 Hours] | Lesson 1: I/O Management and Disk Scheduling, I/O Devices, Organization of the I/O Function | Classroom discussions, Voice over PPT, Lecture video, Lecture note, Open discussion | Presentation,  Final exam | CLO4 |
| Lesson 2: Operating System Design Issues, I/O Buffering Disk Scheduling RAID, Linux I/O | Classroom discussions, Voice over PPT, Lecture video, Lecture note, Open discussion. | Presentation,  Final exam | CLO4 |
| Week-13  Lesson 1 & 2 [3 Hours] | Lesson 1: File Management Overview  File Organization and Access  File Directories | Classroom discussions, Voice over PPT, Lecture video, Lecture note, Open discussion | Presentation, Final Exam | CLO4 |
| Lesson 2: File Sharing  Record Blocking  Secondary Storage Management  Linux File Management | Classroom discussions, Voice over PPT, Lecture video, Lecture note, Open discussion | Presentation, Final Exam | CLO4 |
| Week-14  Lesson 1 & 2 [3 Hours] | Lesson 1: Industry Session | Interactive Lectures and Presentations, Expert Talks, Hands-On Workshops, Site Visits and  Virtual Tours | Presentation, Assignment | CLO1, CLO2, CLO3, CLO4 |
| Lesson 2: Review class on final exam syllabus | Brainstorming sessions, Open discussion | Presentation, Final Exam | CLO2, CLO3, CLO4 |

**Overall Assessment Scheme**

| **Assessment Task** | **CLO’s** | | | | **Mark (Total=100)** | **PLO’s** | | **Mark (Total =70)** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CLO1** | **CLO2** | **CLO3** | **CLO4** | **PLO1** | **PLO2** |
| **Attendance** | **--** | **--** | **--** |  | **7** |  |  |  |
| **Class Test 1** | 5(15) |  |  |  | Avg  15 | 5 |  |  |
| **Class Test 2** |  | 5(15) |  |  |  | 5 |  |
| **Class Test 3** |  |  | 5(15) |  |  | 5 |  |
| **Assignment** |  |  |  |  | 5 |  |  | 5 |
| **Presentation** |  |  |  |  | 8 |  |  |  |
| **Midterm Exam** | 10 | 15 |  |  | 25 | 15 | 10 | 25 |
| **Final exam** |  | 10 | 20 | 10 | 40 | 10 | 30 | 40 |

**Marks Distribution**

| Class attendance | 7 |
| --- | --- |
| Assignment | 5 |
| Presentation (Mandatory) | 8 |
| 3 Quizzes | 15 |
| Midterm Test | 25 |
| Semester Final Examination | 40 |
| 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**

Abraham Silberschatz, Peter B. Galvin, Greg Gagne, Operating System Concepts, 10th Edition, Wiley, 2021, ISBN: 978-1119320913

**Reference Books/ Other Supplementary Readings**

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

**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**

N/A

**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 (POs)**

| **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**

**Cognitive Domain (Knowledge):**

The cognitive domain aims to develop the mental skills and the acquisition of knowledge of the individual.

| **Levels** | **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 |

**Affective Domain:**

The affective domain includes how learners deal with things emotionally, such as feelings, values, appreciation, enthusiasms, motivations, and attitudes.

| **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. |

**Psychomotor Domain:**

Includes physical movement, coordination, and use of the motor-skill areas.

| **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 Skill (4 year’s Bachelors):**

**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