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|  | **East West University**  **Department of Computer Science and Engineering**  **Course Outline**  **FALL 2018 Semester** |  |

**Course Information**

**Course: CSE325 Operating Systems**

**Credit and Teaching Scheme:**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Theory | Laboratory | Total |
| Credits | 3 | 1 | 4 |
| Contact Hours | 3 Hours/Week for 13 Weeks | 2 Hours/Week for 13 Weeks | 5 Hours/Week for 13 Weeks |

**Prerequisite:** None

**Instructor Information**

**Instructor**: Md. Ashraful Islam

Lecturer, Department of Computer Science and Engineering

**Office**: Room # AB2-202

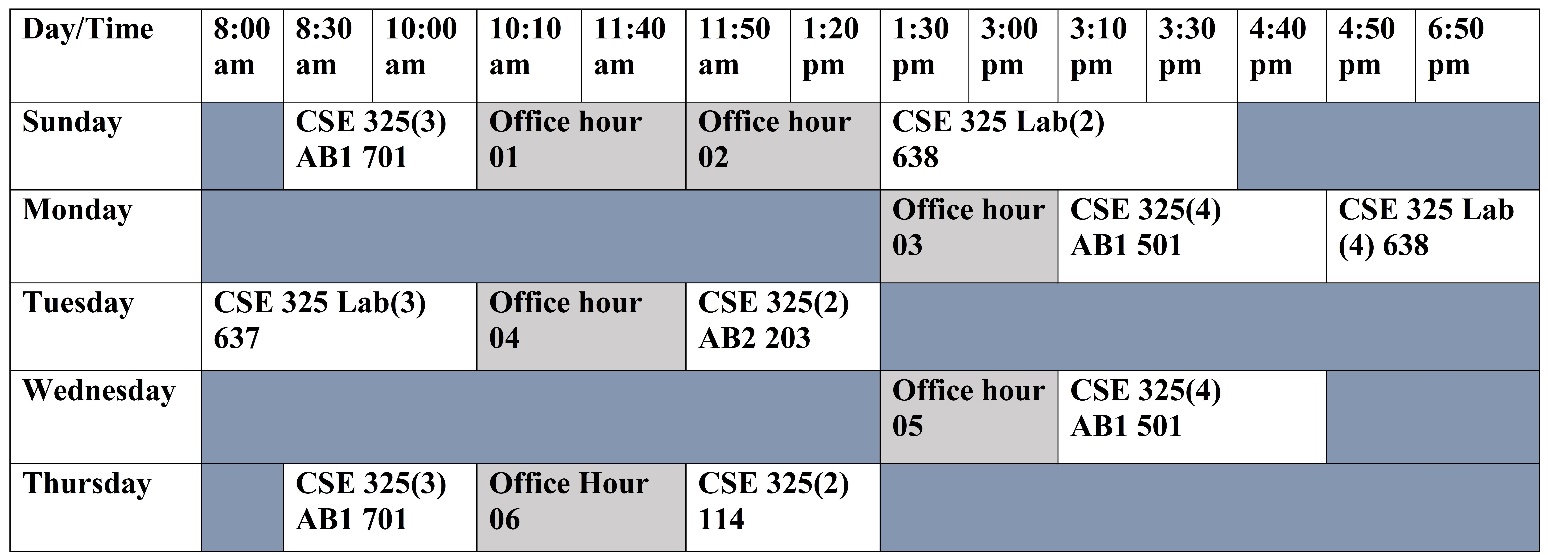
**Tel. No.**:

**E-mail**: ashraful@ewubd.edu

**URL:** https://sites.google.com/site/cseduashraful

**TA:** TBA

**Class Routine and Office Hour**



**Course Objective**

This course introduces the principles and techniques for the design and implementation of operating systems. This course also emphasizes the implementation of various techniques required for management, scheduling, allocation and communication of resources used in operating system. Knowledge of this course will be needed as prerequisite knowledge for future courses such as CSE360 Computer Architecture and CSE452 Distributed Systems and Algorithms.

**Course Outcomes (COs)**

After completion of this course students will be able to:

|  |  |
| --- | --- |
| CO1 | **Interpret**, **use**, and **characterize** different components of modern operating system for examining design goals. |
| CO2 | **Describe**, **use**, and **characterize** different methods of resource management and communication for operating system performance analysis. |
| CO3 | **Interpret**, **apply**, and **characterize** resource management techniques for solving resource constained problems. |
| CO4 | **Implement**  functional, pre-emptive, multi-tasking operating system modules including scheduler, file manager, memory manager, storage manager, and synchronization components; **demonstrate** and **master** these knowledge and **write** report for realistic problem solving. |

**Mapping of Course Outcomes (COs) to Program Outcomes (POs)**

| **CO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CO1** | X |  |  |  |  |  |  |  |  |  |  | X |
| **CO2** | X | X |  |  |  |  |  |  |  |  |  | X |
| **CO3** | X |  | X |  |  |  |  |  |  |  |  | X |
| **CO4** | X | X | X |  | X | X |  |  | X | X |  | X |

**Descriptions of Program Outcomes (POs)**

|  |  |
| --- | --- |
| PO1 | **Engineering Knowledge (Cognitive):** Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems. |
| PO2 | **Problem Analysis (Cognitive):** Identify, formulate, research the literature and analyze complex engineering problems and reach substantiated conclusions using first principles of mathematics, the natural sciences and the engineering sciences. |
| PO3 | **Design/Development of Solutions (Cognitive, Affective):** 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 as well as cultural, societal and environmental concerns. |
| PO4 | **Investigation (Cognitive, Psychomotor):** Conduct investigations of complex problems, considering design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions. |
| PO5 | **Modern Tool Usage (Psychomotor, Cognitive):** 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 the limitations. |
| PO6 | **The Engineer and Society (Affective):** Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice. |
| PO7 | **Environment and Sustainability (Affective, Cognitive):** Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of, and need for sustainable development. |
| PO8 | **Ethics (Affective):** Apply ethical principles and commit to professional ethics, responsibilities and the norms of the engineering practice. |
| PO9 | **Individual Work and Teamwork (Psychomotor, Affective):** Function effectively as an individual and as a member or leader of diverse teams as well as in multidisciplinary settings. |
| PO10 | **Communication (Psychomotor, Affective):** 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. |
| PO11 | **Project Management and Finance (Cognitive, Psychomotor):** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work as a member or a leader of a team to manage projects in multidisciplinary environments. |
| PO12 | **Life-Long Learning (Affective, Psychomotor):** Recognize the need for and have the preparation and ability to engage in independent, life-long learning in the broadest context of technological change. |

**Complex Engineering Problems and Activities**

**Attributes of Complex Engineering Problems Involved**

|  |  |  |
| --- | --- | --- |
| **CO** | **PO** | **Attributes** |
| CO1 | PO1 | Range of conflicting requirements |
| CO2 | PO1,PO2 | Range of conflicting requirements, Consequences |
| CO3 | PO1, PO3 | Range of conflicting requirements, Depth of knowledge required, Extent of applicable codes, Consequences |
| CO4 | PO1, PO2, PO3 | Depth of analysis required, Depth of knowledge required, Familiarity of issues, Extent of applicable codes, Consequences, Interdependence |

**Attributes of Complex Engineering Activities Involved**

|  |  |  |
| --- | --- | --- |
| **CO** | **PO** | **Attributes** |
| CO4 | PO5, PO10 | Range of resources, Level of interaction, Innovation, Familiarity |

**Descriptions of Range of Complex Engineering Problem Solving**

|  |  |
| --- | --- |
| **Attribute** | **Complex Problems** |
| Range of conflicting requirements | Involve wide-ranging or conflicting technical, engineering and other issues |
| Depth of analysis required | Have no obvious solution and require abstract thinking and originality in analysis to formulate suitable models. |
| Depth of knowledge required | Requires research-based knowledge, much of which is at, or informed by, the forefront of Computer Science and Engineering and that allows a fundamental-based, first-principles analytical approach. |
| Familiarity of issues | Involve infrequently encountered issues. |
| Extent of applicable codes | Are outside problems encompassed by standards and codes of practice for professional Computer Science and Engineering. |
| Extent of stakeholder involvement and level of conflicting requirements | Involve diverse groups of stakeholders with widely varying needs. |
| Consequences | Have significant consequences in a range of contexts. |
| Interdependence | Are high-level problems that include many component parts or sub-problems. |

**Descriptions of Range of Complex Engineering Activities**

|  |  |
| --- | --- |
| **Attribute** | **Complex Problems** |
| Range of resources | Involve the use of diverse resources (for this purpose, resources include people, money, equipment, materials, information and technologies) |
| Level of interaction | Require resolution of significant problems arising from interactions between wide-ranging or conflicting technical, engineering or other issues |
| Innovation | Involve creative use of Computer Science and Engineering principles and research-based knowledge in novel ways |
| Consequences to society and the environment | Have significant consequences in a range of contexts, characterized by difficulty of prediction and mitigation |
| Familiarity | Outside problems encompassed by standards and codes of practice for professional Computer Science and Engineering |

**Course Topics, Teaching-Learning Method, and Assessment Scheme**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Topic** | **Teaching-Learning Method** | **CO** | **Cognitive Domain** | | | | **Assessment** |
|  |  |  | **C2** | **C3** | **C4** | **T** | **Exam** |
| Basic concept of operating system | Lecture, Class Discussion, Discussion Outside Class with Instructor/ Teaching Assistant | CO1 | 4 |  |  | 4 | Midterm Exam I  (16) |
|  |
| Operating systems Hardware Interaction (I/O Management) | DO | CO2 |  | 4 |  | 4 |
| Process and Thread | DO | CO1 |  | 4 | 4 | 8 |
| Scheduling algorithms for multi-tasking | DO | CO2 |  | 4 | 4 | 8 | Midterm Exam II  (20) |
| Inter Process Communication (IPC) | DO | CO2 |  | 4 |  | 4 |
| Mutual exclusion principles | Do | CO3 |  | 4 | 4 | 8 |
| Deadlock handling | DO | CO3 | 4 | 4 |  | 8 | Final Exam  (20) |
| Memory Management | Do | CO2 |  | 4 | 4 | 8 |
| Storage Management  Or  File Management | Do | CO2 |  | 4 |  | 4 |

**Assignments**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Course Topic | Teaching-Learning Method | CO | Mark of Cognitive Learning Levels | | Mark of Psycho-motor Learning Levels | Mark of Affective Learning Levels | CO Mark | Exam (Mark) |
| C2 | C3 | P3 | A2 |
| Assignments with reports | Individual, moderately complex assignments | CO1  CO3 |  | 1  1 | 0.75  0.75 | 0.75  0.75 | 2.5  2.5 | Assign-ment  (5) |

**Laboratory Experiments/Project**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Experiment** | **Teaching-Learning Method** | **CO** | **CO**  **Marks** | | | | |
| **P1** | **P2** | **P3** | **P4** |  |
| Familiarization with Lab software.  DOS-Windows-Linux  YASS: A system simulator | Preparing Pre-Lab Report, Lab Experiment and Result Analysis, Preparing Post-Lab Report | CO4 | 1 | 2 | 1(pre) | 1(post) | 5 |
| DOS &UNIX shell concepts such as command expansion and filters.  DOS Command Prompt, Linux Shell, Process Commands | Do |
| Process Management  Linux, GCC,  YASS: A system simulator | Do | CO4 |  | 2 |  | 3 (post) | 5 |
| Thread Management  Linux, GCC, POSIX  YASS: A system simulator |
| Process Scheduling Simulator.  PS Simulator  YASS: A system simulator |
| Threads Synchronization (Mutex & Semaphore). |
| Memory Management |
| File Management  Or  Disk Scheduling |
| Lab Exam | Individual Lab Exam | CO4 |  | 2 | 2 |  | 4 |
| Lab Project including Report and Presentation | Team-based moderately complex Lab Project with report writing, and oral/poster presentation | CO4 |  | 3 | 3 | 4 | 10 |
| **Total** |  |  | **1** | **9** | **6** | **8** | **24** |

**\*Notes:**

* **STRICTLY NO COPYING** from others.
* Submit your Class assignment, Lab assignments and Project in due date. Late submissions suffer a penalty rate of 20% per day, up to five (5) days.
* Project must be completed in the group of atmost four (4).

**Descriptions of Cognitive Domain (Anderson and Krathwohl’s Taxonomy 2001):**

The **cognitive domain** involves the development of our mental skills and the acquisition of knowledge.

|  |  |  |  |
| --- | --- | --- | --- |
| **Level** | **Category** | **Meaning** | **Keywords** |
| C1 | Remembering | Recognizing or recalling knowledge from memory. Remembering is when memory is used to produce or retrieve definitions, facts, or lists, or to recite previously learned information. | Define, describe, draw, find, identify, label, list, match, name, quote, recall, recite, tell, write |
| C2 | Understanding | Constructing meaning from different types of functions be they written or graphic messages or activities like interpreting, exemplifying, classifying, summarizing, inferring, comparing, or explaining. | Classify, compare, exemplify, conclude, demonstrate, discuss, explain, identify, illustrate, interpret, paraphrase, predict, report |
| C3 | Applying | Carrying out or using a procedure through executing, or implementing. *Applying* relates to or refers to situations where learned material is used through products like models, presentations, interviews or simulations. | Apply, change, choose, compute, dramatize, implement, interview, prepare, produce, role play, select, show, transfer, use |
| C4 | Analyzing | Breaking materials or concepts into parts, determining how the parts relate to one another or how they interrelate, or how the parts relate to an overall structure or purpose. Mental actions included in this function are *differentiating, organizing, and attributing,* as well as*being able to distinguish between* the components or parts. When one is analyzing, he/she can illustrate this mental function by creating spreadsheets, surveys, charts, or diagrams, or graphic representations. | Analyze, characterize, classify, compare, contrast, debate, deconstruct, deduce, differentiate, discriminate, distinguish, examine, organize, outline, relate, research, separate, structure |
| C5 | Evaluating | Making judgments based on criteria and standards through checking and critiquing. Critiques, recommendations, and reports are some of the products that can be created to demonstrate the processes of evaluation. | Appraise, argue, assess, choose, conclude, critique, decide, evaluate, judge, justify, predict, prioritize, prove, rank, rate, select, monitor |
| C6 | Creating | Putting elements together to form a coherent or functional whole; reorganizing elements into a new pattern or structure through generating, planning, or producing. Creating requires users to put parts together in a new way, or synthesize parts into something new and different creating a new form or product.  This process is the most difficult mental function. | Construct, design, develop, generate, hypothesize, invent, plan, produce, compose, create, make, perform, plan, produce |

**Descriptions of Psychomotor Domain (Dave’s Taxonomy 1975):**

The **psychomotor domain** includes physical movement, coordination, and use of the motor-skill areas.

|  |  |  |  |
| --- | --- | --- | --- |
| **Level** | **Category** | **Meaning** | **Keywords** |
| P1 | Imitation | Copy action of another; observe and replicate. | Relate, Repeat, Choose, Copy, Follow, Show, Identify, Isolate. |
| P2 | Manipulation | Reproduce activity from instruction or memory | Copy, response, trace, Show, Start, Perform, Execute, Recreate. |
| P3 | Precision | Execute skills reliably; independent of help. | Assemble, Implement, Organize, Calibrate, Demonstrate, Build, Perfect, Control, Complete, Measure. |
| P4 | Articulation | Adapt and integrate expertise to satisfy a non-standard objective. | Modify, Master, Develop, Adapt, Formulate, Coordinate, Combine, Solve, Integrate. |
| P5 | Naturalization | Automated, unconscious mastery of activity and related skills at strategic level. | Design, Rank, Manage, Compose, Develop, Specify, Construct, Invent. |

**Descriptions of Affective Domain (Krathwohl, Bloom, Masia’s Taxonomy 1973):**

The **affective domain** includes the manner in which we deal with things emotionally, such as feelings, values, appreciation, enthusiasms, motivations, and attitudes.

|  |  |  |  |
| --- | --- | --- | --- |
| **Level** | **Category** | **Meaning** | **Keywords** |
| A1 | Receiving | Willingness to participate in an activity to attend to a stimulus; getting and holding the attention of students. | Locate, Give, Point to, Follow, Sit erect, Hold, Name, reply, Identify, Choose |
| A2 | Responding | Actively participates; demonstrates interest in an object, activity or phenomena; seeks or pursues this object, activity or phenomena. | Label, Answer, Perform, Write, Conform, Assist, Recite, Report, Read, Greet, Help, Present, Compile. |
| A3 | Valuing | Value or worth attached to an object, activity or phenomena; varies from simple acceptance to commitment. | Work, Form, Follow, Join, Invite, Justify, Study, Explain, Share, Propose, Select, Complete, Describe, read, report, Differentiate, Initiate. |
| A4 | Organizing | Compare and contrast, and resolve conflict to build a consistent value system; emphasis on comparing and synthesizing values. | Relate, Synthesize, Identify, Prepare, Defend, Generalize, Modify, Integrate, Order, Compare, Complete, Organize, Adhere, Arrange, Combine, and Explain, Alter. |
| A5 | Internalizing | Adopt a value system for a length of time that contributes to a particular “lifestyle” (i.e. directs behavior). | Influence, Propose, Use, Quality, Revise, Serve, Solve, Modify, Display, Practice, Listen, Question, Perform, Act, Discriminate, Verify |

**Overall Assessment Scheme**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Assessment Area** | **Course Outcomes** | | | | **Assessment Area Mark** |
| Assessment Area | **CO1** | **CO2** | **CO3** | **CO4** |  |
| Class Participation | 1.25 | 1.25 | 1.25 | 1.25 | 5 |
| Class Test/Quiz | 2.5 | 2.5 | 2.5 | 2.5 | 10 |
| Assignment | 2.5 |  | 2.5 |  | 5 |
| Midterm Exam - I | 12 | 4 |  |  | 16 |
| Midterm Exam -II |  | 12 | 8 |  | 20 |
| Final Exam |  | 12 | 8 |  | 20 |
| Laboratory Experiments, Exam, Lab Project(s) and Presentation |  |  |  | 24.00 | 24 |
| Total Mark | **18.25** | **31.75** | **22.25** | **27.75** | **100** |

**Teaching Materials/Equipment**

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| --- |
| **Main Text book:**   * A. Silberschatz, P.B. Galvin, G. Gagne. *Operating System Concepts*, 9th Ed. John Wiley & Sons, 2010. ISBN: 0-471-41743-2 |
| **Reference books:**   * Andrew S. Tanenbaum, *Modern Operating System*, 3rd Edition, Prentice Hall. ISBN-13: 9780136006633. |
| **Teaching Materials:**   * Lecture Notes, Textbook, Lab Exercises, Computer Software (GCC, YASS: A system simulator, POSIX), OS (LINUX).   **Lab Manual:**   * Lab Manual will be provided in each lab.   **Assignment:**   * Assignment description will be provided.   **Project Description**   * Project description will be provided.   **Course Web Link:**   * Google Drive:   <https://drive.google.com/drive/folders/1qFe_ofU-7YF7VLI9kuIiviPEv_SBYCHo?usp=sharing>  **Teaching-Learning Method:**   * Lecture Notes\*, Discussions, Lab Exercises\*, Pre/Post-Lab Assignments and Project.   *\*Lecture (ppt) and Lab (sheets) materials will be delivered to students before each lab class.* |

**Grading System**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Marks (%)** | **Letter Grade** | **Grade Point** | **Marks (%)** | **Letter Grade** | **Grade Point** |
| 97-100 | A+ | 4.00 | 73-76 | C+ | 2.30 |
| 90-96 | A | 4.00 | 70-72 | C | 2.00 |
| 87-89 | A- | 3.70 | 67-69 | C- | 1.70 |
| 83-86 | B+ | 3.30 | 63-66 | D+ | 1.30 |
| 80-82 | B | 3.00 | 60-62 | D | 1.00 |
| 77-79 | B- | 2.70 | Below 60 | F | 0.00 |

**Exam Dates**

|  |  |  |  |
| --- | --- | --- | --- |
| **Section** | **Term I** | **Term II** | **Final** |
| 2-TR | 16/10/2018 | 13/11/2018 | 18/12/2018 |
| 3-SR | 15/10/2018 | 15/11/2018 | 20/12/2018 |
| 4-MW | 17/10/2018 | 12/11/2018 | 19/12/2018 |

**Academic Code of Conduct**

**Academic Integrity:**

Any form of cheating, plagiarism, personification, falsification of a document as well as any other form of dishonest behavior related to obtaining academic gain or the avoidance of evaluative exercises committed by a student is an academic offence under the Academic Code of Conduct and **may lead to severe penalties as decided by the Disciplinary Committee of the university.**

**Special Instructions:**

* Students are expected to attend all classes and examinations. A student MUST have at least 80% class attendance to sit for the final exam.
* Students will not be allowed to enter into the classroom after 20 minutes of the starting time.
* For plagiarism, the grade will automatically become zero for that exam/assignment.
* Normally there will be **NO make-up exam**. However, in case of **severe illness, death of any family member, any family emergency, or any humanitarian ground**, if a student misses any exam, the student MUST get approval of makeup exam by written application to the Chairperson through the Course Instructor **within 48 hours** from the exam time. Proper supporting documents in favor of the reason of missing the exam have to be presented with the application.
* For **final exam**, there will be NO makeup exam. However, in case of **severe illness, death of any family member, any family emergency, or any humanitarian ground**, if a student misses the final exam, the student MUST get approval of **Incomplete Grade** by written application to the Chairperson through the Course Instructor **within 48 hours** of the final exam time. Proper supporting documents in favor of the reason of missing the final exam have to be presented with the application. **It is the responsibility of the student to arrange an Incomplete Exam within the deadline mentioned in the Academic Calendar in consultation with the Course Instructor**.
* All mobile phones MUST be turned to silent mode during class and exam period.
* There is **zero tolerance for cheating** in exam. Students caught with cheat sheets in their possession, whether used or not; writing on the palm of hand, back of calculators, chairs or nearby walls; copying from cheat sheets or other cheat sources; copying from other examinee, etc. would be treated as cheating in the exam hall. The only penalty for cheating is **expulsion for several semesters as decided by the Disciplinary Committee of the university**.