
# Green University of Bangladesh

Department of Computer Science and Engineering


# Course Outline

## 1 General Information


| | |
|---|---|
| Faculty | Faculty of Science and Engineering (FSE) |
| Department | Department of Computer Science and Engineering (CSE) |
| Programme | Bachelor of Science in Computer Science and Engineering |
| Semester | **Spring 2023** |
| Course Title | *Algorithms Lab* |
| Course Code | CSE 206 |
| Course Credit | 1.5 units |
| Contact Hours | 2.5 hours/week |
| Course Status | Core Course |
| Prerequisite Course | CSE 105 |

## 2 Course Instructors

| Section | Name | Office | Email |
|---|---|---|---|
| 213 D1 | Ms. Abida Sultana | B407 | abida@cse.green.edu.bd |
| 213 D2 | Md. Mamunur Rahman | C506 | rahman@cse.green.edu.bd |
| 213 D3 | Jargis Ahmed | B502 | jargis@cse.green.edu.bd |
| 213 D4 | Jargis Ahmed | B502 | jargis@cse.green.edu.bd |
| 213 D5 | Md. Rafiqul Islam | C605 | rafiqul@cse.green.edu.bd |
| 213 D6 | Ms. Abida Sultana | B407 | abida@cse.green.edu.bd |
| 213 D7 | Ms. Abida Sultana | B407 | abida@cse.green.edu.bd |
| 213 D8 | Md. Rafiqul Islam | C605 | rafiqul@cse.green.edu.bd |
| 213 EB | Md. Mamunur Rahman | C506 | rahman@cse.green.edu.bd |
| PC 213 DA | Md. Sultanul Islam Ovi | PCR 510 | sultanul@cse.green.edu.bd |
| PC 213 DB | Md. Sultanul Islam Ovi | PCR 510 | sultanul@cse.green.edu.bd |
| PC 213 DC | Md. Sultanul Islam Ovi | PCR 510 | sultanul@cse.green.edu.bd |

## 3 Laboratory and Counseling Hours

| Section | Room | Laboratory Weekday | Laboratory Time | Counseling Weekday | Counseling Time |
|---|---|---|---|---|---|
| 213 D1 | D801 | Monday | 08:00 AM - 10:30 AM | Thursday | 01:30 PM - 02:45 PM |
| 213 D2 | D801 | Tuesday | 01:30 PM - 04:00 PM | Wednesday | 11:45 AM - 01:00 PM |
| 213 D3 | C602 | Tuesday | 10:30 AM - 01:00 PM | Monday | 11:45 AM - 01:00 PM |
| 213 D4 | C602 | Wednesday | 10:30 AM - 01:00 PM | Thursday | 11:45 AM - 01:00 PM |
| 213 D5 | B802 | Tuesday | 10:30 AM - 01:00 PM | Wednesday | 01:30 PM - 02:45 PM |
| 213 D6 | C601 | Thursday | 08:00 AM - 10:30 AM | Thursday | 01:30 PM - 02:45 PM |
| 213 D7 | D801 | Monday | 10:30 AM - 01:00 PM | Thursday | 01:30 PM - 02:45 PM |
| 213 D8 | D801 | Saturday | 10:30 AM - 01:00 PM | Saturday | 01:30 PM - 02:45 PM |
| 213 EB | B802 | Thursday | 04:00 PM - 06:30 PM | Thursday | 11:45 AM - 01:00 PM |

| | | | | | |
|---|---|---|---|---|---|
| PC 213 DA | PCR-503 | Tuesday | 9:00AM - 11:30 AM | Friday | 08:00 AM - 09:15 AM |
| PC 213 DB | PCR-503 | Wednesday | 10:15 AM - 12:45 PM | Friday | 10:30 AM - 11:45 AM |
| PC 213 DC | PCR-503 | Thursday | 9:00AM - 11:30 AM | Friday | 09:15 AM - 10:30 AM |

## 4 Course Rationale

Algorithms are the heart of computer science, and the subject has countless practical applications as well as intellectual depth. This specialization is an introduction to algorithms for learners with at least a little programming experience. The specialization is rigorous but emphasizes the big picture and conceptual understanding over low-level implementation and mathematical details. After completing this specialization, you will be well-positioned to ace your technical interviews and speak fluently about algorithms with other programmers and computer scientists. Algorithms is designed to provide a comprehensive introduction to the design and analysis of computer algorithms and data structures. This course also covers software design methods, object-oriented Implementation issues, and experimental analysis of algorithms.

## 5 Course Description

Techniques for analysis of algorithms; Methods for the design of efficient algorithms: divide and conquer, greedy method, dynamic programming, backtracking, branch and bound; basic search and traversal techniques; topological sorting; connected components, spanning trees, shortest paths; Flow algorithms; Approximation algorithms; Parallel algorithms, Lower bound theory; NP-completeness, NP-hard, and NP-complete problems.

## 6 Teaching Methods

Lecture, Laboratory experiments, Project developments.

## 7 Course Outcomes

| CO | CO Description | PO | Domain (LoBT) | Weight | WK | WP | EA | Assessment Methods |
|---|---|---|---|---|---|---|---|---|
| CO1 | Analyze algorithms and their key components involving running time & memory requirement. | PO2 | Cognitive (C3) | 70% | WK1, WK2 | WP1 | EA1 | Please refer to Section 8. |
| CO2 | Design algorithmic solutions employing suitable approaches for solving complex engineering problems. | PO3 | Cognitive (C4) | 20% | WK2, WK3, WK5 | WP2, WP3 | | |
| CO3 | Adapt algorithmic techniques to solve complex engineering problems through exploring physical and/or online resources. | PO12 | Affective (A4) | 10% | WK5, WK6 | WP5 | | |

**Legend**:

**CO**: *Course Outcome*
**PO**: *Program Outcome* (Appendix: A )
**WK**: *Knowledge Profile* (Appendix: B )
**WP**: *Complex Problem Solving* (Appendix: C )
**EA**: *Complex Engineering Activities* (Appendix: D )
**LoBT**: *Level of Bloom's Taxonomy* (Appendix: E )

## 8 Assessment Methods of COs

| Assessment Method | CO1 | CO2 | CO3 | Total |
|---|---|---|---|---|
| Lab Report | 15% | | | 15% |
| Continues Lab Performance(CLP) | 15% | 10% | | 25% |
| Project, Presentation & Viva | 20% | | 10% | 30% |
| Lab Final | 20% | 10% | | 30% |
| **Total** | 70% | 20% | 10% | 100% |

## 9 Lab Activity Outline

| Class | Experiment Title | COs | Reference | Activities |
|---|---|---|---|---|
| 1 | Socialization and Introduction to the course | 1 | Lab Manual No. 1 | Experiments |
| 2 | Analysis of Complexity of Algorithms | 1 | Lab Manual No. 2 | Experiments |
| 3 | Breadth-First Search Traversal | 1 | Lab Manual No. 3 | Experiments |
| 4 | Depth-First Search Traversal | 1 | Lab Manual No. 4 | Experiments |
| 5 | Kruskal's Algorithm | 2 | Lab Manual No. 5 | Experiments |
| 6 | Prim's Algorithm | 2 | Lab Manual No. 6 | Experiments |
| 7 | Dijkstra's Algorithm | 3 | Lab Manual No. 7 | Experiments |
| 8 | Merge Sort Algorithm | 1 | Lab Manual No. 8 | Experiments |
| 9 | Quick Sort Algorithm | 1 | Lab Manual No. 9 | Experiments |
| 10 | 0-1 Knapsack Problem Using Dynamic Programming (DP) | 2 | Lab Manual No. 10 | Experiments |
| 11 | Huffman Coding Algorithm | 2 | Lab Manual No. 11 | Experiments |
| 12 | String and Pattern Matching Problems using KMP Algorithm | 2 | Lab Manual No. 12 | Experiments |
| 13 | Longest Common Subsequence (LCS) Algorithm | 2 | | Presentation, Viva |
| 14 | Project Presentation | 1, 2, 3 | | Presentation, Viva |
| 15 | **Final Examination** | 1, 2, 3 | | Problem Solving, Viva |

## 10 Text and Reference Materials

**T** Textbook:

- *Thomas H. Cormen*, *Charles E. Leiserson*, *Ronald L. Rivest*, *& Clifford Stein*, **Introduction to Algorithms**, 4th Edition, MIT press, 2022.
- *Jon Kleinberg & Eva Tardos*, **Algorithm Design**, 2rd Edition, Pearson Education, 2006.

**R** References:

- *Anany Levitin*, **Introduction to the Design and Analysis of Algorithms**, 3rd Edition, Pearson Education, 2011.

## 11 Grading Policy

| Marks Obtained | Letter Grade | Numerical Evaluation | Definition |
|---|---|---|---|
| 80% and above | A+ | 4.00 | Excellent |
| 75% <80% | A | 3.75 | Excellent |
| 70% <75% | A- | 3.50 | Very Good |
| 65% <70% | B+ | 3.25 | Good |
| 60% <65% | B | 3.00 | Good |
| 55% <60% | B- | 2.75 | Good |
| 50% <55% | C+ | 2.50 | Average |
| 45% <50% | C | 2.25 | Average |
| 40% <45% | D | 2.00 | Below Average |
| below 40% | F | 0.00 | Failing |

## 12 Additional Course Policies

1. **Equipment and Aids**: Bring your own materials such as a calculator, notebook, and pen to participate effectively in classroom activities. You are NOT allowed to borrow from others inside the classroom which may potentially create distractions for your classmates.
2. **Assignments**: There will be a number of assignments for formative assessment purposes. The average of the assignment marks will be used for computing the final grade. Late submission of homework will carry a zero mark.
3. **Class Tests**: There will be at least three Class Tests taken during the semester and the best two will be counted for final grading. A class test can be taken with/without prior announcement.
4. **Examinations**: The midterm and final examinations will be a closed book, closed notes. Mobile phones are strictly prohibited in the exam hall. Please bring your own watch (non-smart) and synchronize at the beginning of the examination.
5. **Test Policy**: In case of missing a test without prior notice to the respected faculty member, a zero mark will be given. No makeup tests will be taken as the best two test scores will be considered for grading out of three tests.
6. **Mobile Devices Policy**: Empirical evidence of using multitasking devices such as laptops and smartphones in the classroom hinders the learning experience. Thus, the use of multitasking devices is strictly discouraged. Switch off your laptop/mobile devices during class activities.

## 13 Additional Information

Please click or scan:

Academic Calendar Spring, 2023:

Academic Information and Policies:

Proctorial Rules:

Grading and Performance Evaluation:

Md Rafiqul Islam
Course Coordinator, CSE 206
May 6, 2023

Prof. Dr. Md. Saiful Azad
Chairman, Department of CSE
May 6, 2023

# Appendix A : Program Outcomes

| POs | Category | Program Outcomes |
|---|---|---|
| PO1 | Engineering Knowledge | Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems. |
| PO2 | Problem Analysis | 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 | 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 | Investigations | 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 | 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 | 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 | Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of, and need for sustainable development. |
| PO8 | Ethics | Apply ethical principles and commit to professional ethics, responsibilities and the norms of the engineering practice. |
| PO9 | Individual work and teamwork | Function effectively as an individual and as a member or leader of diverse teams as well as in multidisciplinary settings. |
| PO10 | Communication | 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 | 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 | Recognize the need for and have the preparation and ability to engage in independent, life-long learning in the broadest context of technological change. |

# Appendix B : Knowledge Profile

| Knowledge Profile | Attribute |
|---|---|
| WK1 | A systematic, theory-based understanding of the natural sciences applicable to the discipline |
| WK2 | Conceptually based mathematics, numerical analysis, statistics and the formal aspects of computer and information science to support analysis and modeling applicable to the discipline |
| WK3 | A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline |
| WK4 | Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline |
| WK5 | Knowledge that supports engineering design in a practice area |
| WK6 | Knowledge of engineering practice (technology) in the practice areas in the engineering discipline |
| WK7 | Comprehension of the role of engineering in society and identified issues in engineering practice in the discipline: ethics and the engineer's professional responsibility to public safety; the impacts of engineering activity; economic, social, cultural, environmental and sustainability |

| WK8 | Engagement with selected knowledge in the research literature of the discipline |
|---|---|

## Appendix C : Range of Complex Engineering Problem Solving

| Attribute | Identity | Complex Engineering Problem Description |
|---|---|---|
| Depth of knowledge required | WP1 | Cannot be resolved without in-depth engineering knowledge at the level of one or more of K3, K4, K5, K6 or K8 which allows a fundamentals-based, first principles analytical approach |
| Range of conflicting requirements | WP2 | Involve wide-ranging or conflicting technical, engineering and other issues |
| Depth of analysis required | WP3 | Have no obvious solution and require abstract thinking, originality in analysis to formulate suitable models |
| Familiarity of issues | WP4 | Involve infrequently encountered issues |
| Extent of applicable codes | WP5 | Are outside problems encompassed by standards and codes of practice for professional engineering |
| Extent of stakeholder involvement and conflicting requirements | WP6 | Involve diverse groups of stakeholders with widely varying needs |
| Interdependence | WP7 | Are high-level problems including many component parts or sub-problems |

**Note**: Complex Engineering Problems have identity P1 and some or all of P2 to P7.

## Appendix D : Range of Complex Engineering Activities

| Attribute | Identity | Activity Description |
|---|---|---|
| Range of resources | EA1 | Involve the use of diverse resources (and for this purpose resources include people, money, equipment, materials, information and technologies) |
| Level of interaction | EA2 | Require resolution of significant problems arising from interactions between wide-ranging or conflicting technical, engineering or other issues |
| Innovation | EA3 | Involve creative use of engineering principles and researchbased knowledge in novel ways |
| Consequences for society and the environment | EA4 | Have significant consequences in a range of contexts, characterized by difficulty of prediction and mitigation |
| Familiarity | EA5 | Can extend beyond previous experiences by applying principles-based approaches |

**Note:** Complex activities means (engineering) activities or projects that have some or all of the above activities.

## Appendix E : Domain and Level of Bloom's Taxonomy

| Cognitive Domain | | Psychomotor Domain | | Affective Domain | |
|---|---|---|---|---|---|
| C1 | Remembering | P1 | Perception | A1 | Receive |
| C2 | Understanding | P2 | Set | A2 | Respond |
| C3 | Applying | P3 | Guided Response | A3 | Value |
| C4 | Analyzing | P4 | Mechanism | A4 | Organize |
| C5 | Evaluating | P5 | Complex Overt Response | A5 | Internalize |
| C6 | Creating/ Designing | P6 | Adaption | | |
| | | P7 | Origination | | |