# COURSE OUTLINES

**FACULTY OF ELECTRICAL ENGINEERING**
**UNIVERSITI TEKNOLOGI MARA**
**SHAH ALAM**

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|---|---|
| **PROGRAMME** | Bachelor of Electronics Engineering with Honours (CEEE222) |
| **COURSE** | Data Structures and Algorithms (ECE532) |
| **CREDIT HOUR** | 3 |
| **SEMESTER** | October – February |

**SYNOPSIS:**

This course is designed to introduce data structures such as linked lists, stacks, queues, trees and graphs. The course covers algorithmic strategies, including divide-and-conquer, greedy algorithms and various searching and sorting techniques. Additionally, the course introduces the principles of hashing, exploring various hash functions and the design of hash tables to efficiently manage and retrieve data. Special focus is given to understanding and evaluating the performance of different algorithms, preparing students to design and implement solutions that optimize performance in practical engineering tasks.

**COURSE OUTCOMES (CO):**

| At the end of this course, the students should be able to: | |
|---|---|
| **CO1** | Identify data structures within algorithmic frameworks to solve computational problems. |

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|---|---|
| **CO2** | Examine appropriate data structures and algorithms to solve problems in the engineering domain. |

**PROGRAM OUTCOMES (PO):**

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|---|---|
| **PO2** | Identify, formulate, research literature and analyse complex electronic engineering problems reaching substantiated conclusions. |
| **PO3** | Ability to design solutions for complex electronics engineering problems with appropriate consideration for public health and safety, culture, society, and environment. |

**CO - PO MATRIX:**

| | PO2 | PO3 |
|---|---|---|
| **CO1** | ✓ | |
| **CO2** | | ✓ |

| **SUSTAINABLE DEVELOPMENT GOALS (SDGs)** | |
|---|---|
| **SDG9** | Industry, Innovation and Infrastructure |

| **A.D.A.B MODEL DELIVERY** | | **VALUE & ELEMENT CODE** | |
|---|---|---|---|
| **Synthesize** | Get students to reflect in writing on how the choice of data structures impacts algorithm performance in real-world applications like scheduling or routing. Encourage group sharing to synthesize multiple perspectives. | **B3** | Nilai Berbuat Kebaikan |
| **Create** | Assign students to design and implement an efficient algorithm for a real-life scenario. Require them to justify their structure choices and consider societal benefits in their design. End with a short reflection on how such solutions can serve humanity. | **B5** | Hubungan dengan Tuhan |

## COURSE EVALUATION:

| Course Work | Percentage |
|---|---|
| 1. Test<br>2. Assignment<br>3. Miniproject | **30%**<br>**30%**<br>**40%** |
| **Total Course Work** | **100%** |
| **Final Examination** | **0%** |
| **Total Marks** | **100%** |

## RECOMMENDED TEXT


1. Goodrich, M. T., Tamassia, R., & Goldwasser, M. H. (2021). Data structures and algorithms in Python. Wiley. ISBN: 9789354247866.


## REFERENCES


1. Canning, J., Broder, A., & Lafore, R. (2023). Data structures & algorithms in Python. Addison-Wesley Professional. ISBN: 9780134855684.
2. Agarwal, B. (2022). Hands-on data structures and algorithms with Python. Packt Publishing. ISBN: 9781801073448.
3. Abella, H. (2024). Data structures and algorithms in Python: Activate the power of your mind. Aluna Publishing House. ISBN: 9798879863154.
4. Rocca, M. L. (2021). Advanced algorithms and data structures. Manning. ISBN: 9781617295485.
5. Cormen, T. H. (2022). Introduction to algorithms. The MIT Press. ISBN: 9780262046305.


## LECTURER

1. Associate Professor Ts. Dr. Roslina binti Mohamad (Coordinator)
2. Dr. Shuria binti Saaidin
3. Norakmar Binti Arbain Sulaiman

**LESSON PLAN:**

| WEEK/ DATE | CHAPTER/ TOPIC | CO | PO | A.D.A.B MODEL/ VALUE/SDG | ASSESSMENT |
|---|---|---|---|---|---|
| 1<br><br>28 Sept – 2 Oct 2026 | Algorithmic Formalism and Programming Techniques<br>• Algorithmic formalism and techniques<br>• Structured programming techniques | CO1<br>CO2 | PO2<br>PO3 | Synthesize<br>B3 - Nilai Berbuat Kebaikan | Assignment<br>Test<br>Mini Project |
| 2<br><br>5 – 9 Oct 2026 | Algorithmic Formalism and Programming Techniques<br>• Procedural-oriented programming techniques | CO1<br>CO2 | PO2<br>PO3 | Synthesize<br>B3 - Nilai Berbuat Kebaikan | Assignment<br>Test<br>Mini Project |
| 3<br><br>12 – 16 Oct 2026 | Algorithmic Formalism and Programming Techniques<br>• Object-oriented programming techniques | CO1<br>CO2 | PO2<br>PO3 | Create<br>B5 - Hubungan dengan Tuhan | Assignment<br>Test<br>Mini Project |
| 4<br><br>19 – 23 Oct 2026 | Fundamental of Data Structures<br>• Linked List | CO1<br>CO2 | PO2<br>PO3 | Synthesize<br>B3 - Nilai Berbuat Kebaikan | Assignment<br>Test<br>Mini Project |

| WEEK/ DATE | CHAPTER/ TOPIC | CO | PO | A.D.A.B MODEL/ VALUE/SDG | ASSESSMENT |
|---|---|---|---|---|---|
| 5<br><br>26 – 30 Oct 2026 | Fundamental of Data Structures<br>• Stack<br>• Queue | CO1<br>CO2 | PO2<br>PO3 | Synthesize<br>B3 - Nilai Berbuat Kebaikan | Assignment<br>Test<br>Mini Project |
| 6<br><br>2 – 6 Nov 2026 | Fundamental of Data Structures<br>• Stack Applications (Infix, Prefix, Postfix) | CO1<br>CO2 | PO2<br>PO3 | Create<br>B5 - Hubungan dengan Tuhan | Assignment<br>Test<br>Mini Project |
| 7<br><br>9 – 13 Nov 2026 | Trees<br>• Tree concept and terminology<br>• Binary tree, binary search tree and binary expression tree | CO1<br>CO2 | PO2<br>PO3 | Synthesize<br>B3 - Nilai Berbuat Kebaikan | Assignment<br>Test<br>Mini Project |
| **TEST 1 (16 Nov 2026 – 20 Nov 2026)** | | | | | |
| 8<br><br>16 – 20 Nov 2026 | Trees<br>• Tree traversals (inorder, preorder and postorder)<br>• Heap | CO1<br>CO2 | PO2<br>PO3 | Create<br>B5 - Hubungan dengan Tuhan | Assignment<br>Test<br>Mini Project |

| WEEK/ DATE | CHAPTER/ TOPIC | CO | PO | A.D.A.B MODEL/ VALUE/SDG | ASSESSMENT |
|---|---|---|---|---|---|
| 9<br><br>23 – 27 Nov 2026 | Graphs<br>• Types of graphs<br>• Adjacency matrix<br>• Adjacency list<br>• Graph traversal (breadth-first and depth-first search) | CO1<br>CO2 | PO2<br>PO3 | Synthesize<br>B3 - Nilai Berbuat Kebaikan | Assignment<br>Test<br>Mini Project |
| 10<br><br>30 Nov – 4 Dec 2026 | Graphs<br>• Minimum spanning trees (Kruskal's and Prim's algorithms)<br>• Djikstra's shortest path algorithm | CO1<br>CO2 | PO2<br>PO3 | Create<br>B5 - Hubungan dengan Tuhan | Assignment<br>Test<br>Mini Project |
| 11<br><br>07 – 11 Dec 2026 | Algorithmic Strategies<br>• Divide-and-conquer algorithm<br>• Greedy algorithm | CO1<br>CO2 | PO2<br>PO3 | Synthesize<br>B3 - Nilai Berbuat Kebaikan | Assignment<br>Test<br>Mini Project |
| 12<br><br>14 – 18 Dec 2026 | Algorithmic Strategies<br>• Searching algorithms<br>• Sorting algorithms<br>• Performance of algorithms | CO1<br>CO2 | PO2<br>PO3 | Create<br>B5 - Hubungan dengan Tuhan | Assignment<br>Test<br>Mini Project |
| **MID-SEM BREAK/SPECIAL BREAK (21 Dec – 27 Dec 2026)** | | | | | |

| WEEK/ DATE | CHAPTER/ TOPIC | CO | PO | A.D.A.B MODEL/ VALUE/SDG | ASSESSMENT |
|---|---|---|---|---|---|
| **TEST 2 (28 Dec 2026 – 01 Jan 2027)** | | | | | |
| 13<br><br>28 Dec – 01 Jan 2027 | Hashing<br>• Hash function | CO1<br>CO2 | PO2<br>PO3 | Synthesize<br>B3 - Nilai Berbuat Kebaikan | Assignment<br>Test<br>Mini Project |
| 14<br><br>04 – 08 Jan 2027 | Hashing<br>• Hash table | CO1<br>CO2 | PO2<br>PO3 | Create<br>B5 - Hubungan dengan Tuhan | Assignment<br>Test<br>Mini Project |
| **MINIPROJECT DEMONSTRATION (04 Jan – 23 Jan 2027)** | | | | | |
| **REVISION WEEK (11 Jan – 17 Jan 2027)** | | | | | |
| **FINAL EXAMINATION (18 Jan – 7 February 2027)** | | | | | |
| **SEMESTER BREAK (5 February – 14 March 2027)** | | | | | |