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| AIUB-Logo  American International University-Bangladesh (AIUB) | **AMERICAN INTERNATIONAL UNIVERSITY-BANGLADESH (AIUB)**  Faculty of Science and Information (FST)  Department of Computer Science (CS)  Undergraduate Program |



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| **COURSE PLAN** | **Spring 2020-2021** SEMESTER |

**V. Vision:**

Our vision is to be the preeminent Department of Computer Science through creating recognized professionals who will provide innovative solutions by leveraging contemporary research methods and development techniques of computing that is in line with the national and global context.

**VI. Mission:**

The mission of the Department of Computer Science of AIUB is to educate students in a student-centric dynamic learning environment; to provide advanced facilities for conducting innovative research and development to meet the challenges of the modern era of computing, and to motivate them towards a life-long learning process.

I. Course Code and Title

**CSC 3220: Compiler Design**

II. Credit

**3 credit hours (3+2 hours of Lab+Theory per week)**

III. Nature

**Core Course for CS, CSE, CSSE, SE, CIS**

IV. Prerequisite

**CSC 3113: Theory of Computation**



**VII - Course Description:**

* Define Preprocessor, compiler, Assembler and Linker;
* Describe how high-level languages can be implemented on a computer.
* Include specification of languages and its relation to automata, lexical analysis, finite state machines, context free languages, LL and LR parsing methods, syntax directed translation, error recovery, code generation, and portability
* Analyze the principles, algorithms and data structures involved in the design and constructions of compilers.

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**VIII – Course outcomes (CO) Matrix:**

By the end of this course, students should be able to:

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| **COs**\* | **CO Description** | Level of Domain\*\* | | | | PO Assessed\*\*\* | |
| C | P | A | S |
| CO1 | Describe a compiler including its analysis and synthesis part. | 2 |  |  |  | 1.1 | |
| CO2 | Apply methods to automate compiler construction. | 3 |  |  |  | 1.2 | |
| CO3 | Design your deterministic machine based on compiler construction methods |  | 6 |  |  | 3.1 | |
| CO4 | Create a parse table from a context free grammar for any given language. |  | 6 |  |  | 3.2 | |
| *C: Cognitive; P: Psychomotor; A: Affective; S: Soft-skills (CT: Critical Thinking, TS: Teamwork)*  *\* CO assessment method and rubric of COs assessment is provided in Appendix section \*\* The numbers under the ‘Level of Domain’ columns represent the level of Bloom’s Taxonomy each CO corresponds to.*  *\*\*\* The numbers under the ‘PO Assessed’ column represent the PO (appendix) each CO corresponds to.* | | | | | | |

 **IX – Topics to be covered in Theory class\*:**

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| **TOPICS** | **Specific Objective(s)** | | **Time Frame** | | **Suggested Activities** | **Teaching Strategy(s)** | **PO Mapped** |
| Mission & Vision of AIUB;  Introduction to Compilers  and  Simple  one-pass compiler | * Analysis of Source Programs * Compiler Construction tools * Syntax. * Translation basics * Parsing * Lexical Analyzer * Quiz 1 | | Week  1,2 | | Group Discussion | Lecture  Homework assignment  Power point slide | CO1 |
| Lexical Analysis  &  Lexical Analysis  Contd.  &  Syntax Analysis | * Finite Automata * Regular Expression to NFA * Quiz 2 * Basics * Context Free Grammar | | Week  3,4 | | Group Discussion | Lecture  Power point slide  Homework assignment | CO1  &  CO2 |
| Syntax Analysis  &  Syntax Analysis  Contd. | * Ambiguous Grammar * Syntax Directed Definition * Quiz 3 | | Week  5,6 | | Group Discussion | Lecture  Power point slide  Homework assignment | CO1  &  CO2 |
| **Midterm Exams (Week 7)** | | | | | | | |
| Lexical Analysis  &  Syntax Directed Translation | * Rules * Input Buffering * Tokens | Week 8,9 | | Group Discussion | | Lecture  Power point slide  Homework assignment | CO3 |
| Lexical Analysis  &  Syntax Directed Translation  Contd. | * Conversion of an NFA to DFA. * Construction of an NFA from a Regular Expression. * Quiz 4 | Week 10,11 | | Group Discussion | | Lecture  Power point slide  Homework assignment | CO4 |
| Syntax Analysis | * The Role of the Parser * Writing a Context Free Grammar * Top-down Parsing * Bottom-up parsing | Week 12 | | Group Discussion | | Lecture  Power point slide  Homework assignment |  |
| Syntax Analysis  Contd | * LR parsers * Parser Generators * Quiz 6 | Week 13 | | Group Discussion | | Lecture  Homework Assignment in a group. |  |
| **Final Exams (Week 14)** | | | | | | | |

\* The faculty reserves the right to change, amend, add or delete any of the contents.

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**XI- Course Requirements**

At least **80% class attendance** is necessary to sit for the exam. If there is any assignment given to the students, they have to submit it before the deadline decided by the course teacher.

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**XII – Evaluation & Grading System**

The following grading system will be strictly followed in this class

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| **Marking system for Compiler Design**  **(Midterm and Final term)** | |
| Quiz | 30% |
| Attendance | 10% |
| Assignment | 10% |
| Finalterm | 50% |
| **Total** | 100% |
| **Final Grade/ Grand Total** | |
| Midterm: | 40% |
| Final Term: | 60% |

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| **Letter** | **Grade Point** | **Numerical %** |
| A+ | 4.00 | 90-100 |
| A | 3.75 | 85<90 |
| B+ | 3.50 | 80<85 |
| B | 3.25 | 75<80 |
| C+ | 3.00 | 70<75 |
| C | 2.75 | 65<70 |
| D+ | 2.50 | 60<65 |
| D | 2.25 | 50<60 |
| F | 0.00 | <50(Failed) |

**Grand Total - - - - - - - -40% of Midterm + 60% of Final Term**

The evaluation system will be strictly followed as par the AIUB grading policy.

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**XIII – Teaching Methods**

Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some Class notes will be uploaded on the web. White board will be used for most of the time.

For some cases, multimedia projector will be used for the convenience of the students. Students must study up to the last lecture before coming to the class and it is suggested that they should go through the relevant chapter before coming to the class. Just being present in the class is not enough- students must participate in classroom discussions.

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**XIV – Textbook/ References**

1. Compilers-Principles, techniques and tools (2nd Edition)

V. Aho, Sethi and D. Ullman

1. Principles of Compiler Design (2nd Revised Edition 2009)

A. A. Puntambekar

1. **Basics of Compiler Design**

Torben Mogensen



**XV - List of Faculties Teaching the Course**

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| SHARFUDDIN MAHMOOD |
| 1203-1303-2 |
| SAJIB HASAN |
| 1401-1485-2 |
| TOHEDUL ISLAM |
| 1408-1554-2 |
| NAZMUS SAKIB SHAN |
| 2001-2040-2 |
| MD. MEHEDI HASSAN ONIK |
| 2001-2039-2 |
| MD MASUM BILLAH |
| 1909-2003-2 |



**XVI – Verification:**

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| **Prepared by :**  ---------------------------------  **Tohedul Islam**  *Course Convener*  Date:......................................... | **Moderated by :**  ---------------------------------  **Dr Md Mahbub Chowdhury Mishu**  *Point Of Contact*  *OBE Implementation Committee for CS*  Date:......................................... | |
| **Checked by:**  ....................................................  **Dr. M. M. Mahbubul Syeed**  *Head*,  *Department of Computer Science*  Date:.......................................... | **Certified by:**  .........................................................  **Dr. Dip Nandi**  *Director*,  *Faculty of Science & Information Technology*  Date:............................................... | **Approved by:**  .........................................................  **Mr. Mashiour Rahman**  *Associate Dean*,  *Faculty of Science & Information Technology*  Date:............................................... |

**APPENDIX**

**Program Outcomes (POs):**

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| PO1 | Engineering Knowledge |
| 1.1 | Apply the knowledge of mathematics, science, engineering fundamentals to the solution of complex engineering problems. |
| 1.2 | Apply the knowledge of an engineering specialization to the solution of complex engineering problems |
| PO3 | **Design/Development of solution** |
| 3.1 | Design solution for complex engineering problems. |
| 3.2 | 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 |

## **Mapping of CO Assessment Method and Rubric**

The mapping between Course Outcome(s) (COs) and The Selected Assessment method(s) and the mapping between Assessment method(s) and Evaluation Rubric(s) is shown below:

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| --- | --- | --- | --- | --- |
| CO | Description | Learning Domain | Assessment Method | Assessment Rubric |
| CO1 | Describe a compiler including its analysis and synthesis part. | Cognitive | Quiz | Rubric for Quiz |
| CO2 | Apply methods to automate compiler construction. | Cognitive | Mid Term Exam | Rubric for Mid Term Exam |
| CO3 | Design your deterministic machine based on compiler construction methods | Psychomotor | Quiz | Rubric for Quiz |
| CO4 | Create a parse table from a context free grammar for any given language. | Psychomotor | Final Term Exam | Rubric for Final Term Exam |

## **Rubric for Quiz Assessment (CO1)**

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| --- | --- | --- | --- | --- |
| CO1 | *Describe a compiler including its analysis and synthesis part.* | *Cognitive* | Quiz | Rubric for Quiz |

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| Marking Criteria | Marks Distribution (Maximum 5X3=15) | | | | Acquired Marks |
| **Inadequate (0-2)** | **Satisfactory (3)** | **Good (4)** | **Excellent (5)** |
| Definition | * Student vaguely define the terms or the concept. | * Definition provided with partial relevance to the subject matter. | * Correctly define the terms. May miss minor detail. | * Comprehensively defines the terms. |  |
| Logical Argument | * No logical arguments / explanation supporting the definition. | * Offers lossy related arguments. | * Strong argument / explanation offered. | * Comprehensive argument presented to clarify the concept. |  |
| Relevant Example | * No representative example. | * Correctly identify / indicate towards real-life example. | * Real-life example is strongly connected towards the definition. | * Comprehensively defend with real life example. |  |
| Acquired Marks: | | | | |  |
| CO Pass / Fail: | | | | |  |

## **Rubric for Midterm Exam Assessment (CO2)**

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| CO2 | *Apply* methods to automate compiler construction*.* | Cognitive | Mid Term Exam | Rubric for Midterm Exam |

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| Marking Criteria | Marks Distribution (Maximum 5X3=15) | | | | Acquired Marks |
| **Inadequate (0-2)** | **Satisfactory (3)** | **Good (4)** | **Excellent (5)** |
| Method Used | Method is very weak. | Method is partially good. | Correctly define the method. May miss minor detail. | Comprehensively defines the Method. |  |
| Relevant Arguments | No logical arguments / explanation supporting the definition. | Offers lossy related arguments. | Strong argument / explanation offered. | Comprehensive argument presented to clarify the concept. |  |
| Relevant Examples | No representative example. | Correctly identify / indicate towards real-life example. | Real-life example is strongly connected towards the definition. | Comprehensively defend with real life example. |  |
| Acquired Marks: | | | | |  |
| CO Pass / Fail: | | | | |  |

## **Rubric for Quiz Assessment (CO3)**

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| CO3 | *Design your deterministic machine based on compiler construction methods* | *Psychomotor* | Quiz | Rubric for Quiz |

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| --- | --- | --- | --- | --- | --- |
| Marking Criteria | Marks Distribution (Maximum 5X3=15) | | | | Acquired Marks |
| **Inadequate (0-2)** | **Satisfactory (3)** | **Good (4)** | **Excellent (5)** |
| Design | Design is very poor | Design is partially correct | Correct design May lack some minor details | Comprehensive Design |  |
| Design Convention | Poorly Followed | Moderately followed | Correctly followed but ignored some tiny details | Perfectly followed |  |
| Result Analysis | No analysis at all | Very naïve analysis | Good analysis with some ignorable errors | Comprehensive analysis |  |
| Acquired Marks: | | | | |  |
| CO Pass / Fail: | | | | |  |

## **Rubric for Final term Exam Assessment (CO4)**

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| CO4 | *Create a parse table from a context free grammar for any given language.* | *Psychomotor* | Final Term Exam | Rubric for Final term Exam |

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| Marking Criteria | Marks Distribution (Maximum 5X3=15) | | | | Acquired Marks |
| **Inadequate (0-2)** | **Satisfactory (3)** | **Good (4)** | **Excellent (5)** |
| Convention Followed | Design is very poor | Design is partially correct | Correct design May lack some minor details | Comprehensive Design |  |
| Final Outcome | No Outcome | Partially found Outcome | Final Outcome with some minor error | Final Outcome |  |
| Result Analysis | No analysis at all | Very naïve analysis | Good analysis with some ignorable errors | Comprehensive analysis |  |
| Acquired Marks: | | | | |  |
| CO Pass / Fail: | | | | |  |