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| A picture containing diagram  Description automatically generated | **AMERICAN INTERNATIONAL UNIVERSITY-BANGLADESH (AIUB)**  Faculty of Science and Technology (FST)  Department of Computer Science (CS)  Undergraduate Program |

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| **COURSE PLAN** | **SEMESTER: Summer 2023-2024** |
| 1. **Course Core and Title**   CSC 3220 Compiler Design   1. **Credit**   3 credit hours (3 hours of Lab and 2 hours of theory per week)   1. **Nature**   Core Course for CS, CSE, CSSE, SE, CIS   1. **Prerequisite**   CSC 3113 Theory of Computation | 1. **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.   1. **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. |

# 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.

# 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 |
| CO1 | **Illustrate** a solution for a complex problem using the principles of existing computational models | 4 |  |  | PO-c-3 |
| CO2  \*\* | **Analyse** methods to automate compiler construction. | 4 |  |  | PO-c-3 |
| CO3\*\* | **Evaluate** your designed deterministic machine based on compiler construction methods | 5 |  |  | PO-g-2 |
| CO4 | **Compare** parse table from a context free grammar for any given language. | 5 |  |  | PO-g-2 |
| *C: Cognitive; P: Psychomotor; A: Affective Domain*  *\* CO assessment method and rubric of COs assessment is provided in later section*  *\*\* COs will be mapped with the Program Outcomes (POs) for PO attainment \*\*\* The numbers under the ‘Level of Domain’ columns represent the level of Bloom’s Taxonomy each   CO corresponds to.*  *\*\*\*\* The numbers under ‘PO Assessed’ column represent the POs each CO corresponds to.* | | | | | |

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

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| **Time Frame** | **CO**  **Mapped** | **Topics** | **Teaching**  **Activities** | **Assessment Strategy(s)** |
| Week 1 | CO1 | Knowing Mission & Vision of AIUB. Introducing the concept of OBE(Outcome Based Education).  Introduction to Compilers and Simple one-pass compiler | Lecture, Question-answer, Homework | Quiz, Term Exam |
| Week 2 | CO1 | Different Phases of a Compiler | Lecture, Question-answer, Homework | Quiz, Term Exam |
| Week 3 | CO1, CO2 | Linker and Loader, Front End and Back End of a Compiler | Lecture, Question-answer, Homework | Quiz, Term Exam |
| Week 4 | CO1, CO2 | Symbol Table Management, Error Handler | Lecture, Question-answer, Homework | Quiz, Term Exam |
| Week 5 | CO4 | A Simple Syntax Directed Translator | Lecture, Question-answer, Homework | Quiz, Term Exam |
| Week 6 | CO2, CO4 | Synthesized Attribute, Inherited Attributed, Context free Grammar | Lecture, Question-answer, Homework | Quiz, Term Exam |
| Week 7 |  | Regular Expression, Construction of  an NFA from a Regular Expression | Lecture, Question-answer, Homework | Quiz, Term Exam |
| Midterm (Week 8) | | | | |
| Week 9 | CO3 | Conversion of an NFA to DFA, Deterministic Finite Automata. | Lecture, Question-answer, Homework | Quiz, Term Exam |
| Week 10 | CO3 | Input Buffering, Lexical Analyzer, First Set. | Lecture, Question-answer, Homework | Quiz, Term Exam |
| Week 11 | CO3 | First Set, Follow Set | Lecture, Question-answer, Homework | Quiz, Term Exam |
| Week 12 | CO4 | Construct Parsing Table from First Set and Follow Set | Lecture, Question-answer, Homework | Quiz, Term Exam |
| Week 13 | CO4 | Implement the Syntax Analyzer using Parsing Table. | Lecture, Question-answer, Homework | Quiz, Term Exam |
| Week 14 | CO4 | Implementing L-Attributed SDD’s | Lecture, Question-answer, Homework | Quiz, Term Exam |
| Week 15 | CO4 | L-Attributed SDD-s and LL Parsing | Lecture, Question-answer, Homework | Quiz, Term Exam |
| Final term (Week 16) | | | | |

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

# X – Mapping of PO/PLO and K, P, A of this course

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| PO Indicator ID | PO Indicators Definition (As per the requirement of WKs) | Domain | K | P | A |
| PO-c-3 | Apply engineering management principles and economic decision making to solve engineering projects as a team | Cognitive Level 4  (Analyzing) | K5 | P1  P2  P6 |  |
| PO-g-2 | Evaluate the sustainability and impact of professional engineering work in the solution of complex engineering problems in societal and environmental contexts. | Cognitive Level 5 (Evaluating) | K7 |  |  |

# XI – K, P, A Definitions

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| **Indicator** | **Title** | **Description** |
| K5 | Engineering Design | Knowledge that supports engineering design in a practice area. |
| K7 | Comprehension of engineering in society | 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 |
| P1 | Depth of knowledge required | 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 |
| P2 | Range of conflicting requirements | Involve wide-ranging or conflicting technical, engineering and other issues |
| P6 | Extent of stakeholder involvement and conflicting requirements | Involve diverse groups of stakeholders with widely varying needs |

# XII – 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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| **COs** | **Description** | **Mapped POs** | **Assessment Method** | **Assessment Rubric** |
| CO1 | Illustrate a solution for a complex problem using the principles of existing computational models | PO-c-3 | Term Exam | Rubric for Term Exam |
| CO2 | Analyze methods to automate compiler construction. | PO-c-3 | Term Exam | Rubric for Term Exam |
| CO3 | Evaluate your designed deterministic machine based on compiler construction methods | PO-g-2 | Term Exam | Rubric for Term Exam |
| CO4 | Compare parse table from a context free grammar for any given language. | PO-g-2 | Quiz/ Term Exam | Rubric for Term Exam/Quiz |

# XIII – Evaluation and Assessment Criteria

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| **CO1:** Design a solution for a complex problem using the principles of existing computational models | | | | | |
| **Assessment Criteria** | **Not Attended/ Incorrect (0)** | **Inadequate  (1-2)** | **Average (3)** | **Good  (4)** | **Excellent (5)** |
| **Evaluation Criteria** | **Evaluation Definition** | | | | |
| Problem Analysis | Student knows the proper definition/ usage of a different phases of a compiler. | | | | |
| Socio-cultural Impact | Student can relate the theory with the given problem statement. | | | | |
| Related Solutions and Studies | Student can provide a real-life example. | | | | |

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| **CO2:** Apply methods to automate compiler construction. | | | | | |
| **Assessment Criteria** | **Not Attended/ Incorrect (0)** | **Inadequate  (1-2)** | **Average (3)** | **Good  (4)** | **Excellent (5)** |
| **Evaluation Criteria** | **Evaluation Definition** | | | | |
| Methods | Student can define method of the automata theory. | | | | |
| Relevant Arguments | Student can follow relevant arguments for a given problem. | | | | |
| Relevant Examples | Student can relate the with the conventions for a given problem. | | | | |

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| **CO3:** Evaluate your designed deterministic machine based on compiler construction methods | | | | | |
| **Assessment Criteria** | **Not Attended/ Incorrect (0)** | **Inadequate  (1-2)** | **Average (3)** | **Good  (4)** | **Excellent (5)** |
| **Evaluation Criteria** | **Evaluation Definition** | | | | |
| Content knowledge | Demonstrates full knowledge of the principles of compiler construction methods & tools. | | | | |
| Selection and Argumentation | Articulates a position or argument for the choosing the correct practice and principles of compiler design | | | | |

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| **CO4:** Create parse table from a context free grammar for any given language. | | | | | |
| **Assessment Criteria** | **Not Attended/ Incorrect (0)** | **Inadequate  (1-2)** | **Average (3)** | **Good  (4)** | **Excellent (5)** |
| **Evaluation Criteria** | **Evaluation Definition** | | | | |
| Definition | Briefly elaborate the background information of the problem area. | | | | |
| Methodology | Apply proper methodology to implement a compiler using syntax-directed translation methods. | | | | |
| Results | Apply synthesized and inherited attributes concept to construct a compiler for parsing. | | | | |

# XI- Course Requirements

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

# XV – Evaluation & Grading System\*

The following grading system will be strictly followed in this course.

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| **Mid-term** | **Final term** |
| Class Attendance: 10%  Quizzes: 30%  Lab Evaluation: 10%  Term Exam: 50% | Class Attendance: 10%  Quizzes: 30%  Lab Evaluation: 10%  Term Exam: 50% |
| **Total Midterm Marks: 40%** | **Total Final term marks: 60%** |
| **Grand Total: 100 Marks** | |

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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 |
| I |  | Incomplete |
| W |  | Withdrawal |
| UW |  | Unofficially Withdrawal |

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

*\* CO attainment will be achieved with 60% of the evaluation marks.*

# 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.

# XIV – Textbook/ References

1. Compilers-Principles, Techniques and Tools (2nd Edition) V. Aho, Sethi and D. Ullman
2. Principles of Compiler Design (2nd Revised Edition 2009) A. A. Puntambekar
3. Basics of Compiler Design Torben Mogensen.

# XVII - List of Faculties Teaching the Course

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| FACULTY NAME | SIGNATURE |
| MD. MASUM BILLAH |  |
| K. M. IMTIAZ-UD-DIN |  |
| Nazmus Sakib Shan |  |
| Aiman Lameesa |  |

# XVIII – Verification

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| **Prepared by:**  ---------------------------------  **Md Masum Billah**  *Course Convener*  Date:......................................... | **Moderated by:**  ---------------------------------  **Dr. M. Mahmudul Hasan**  *Point Of Contact*  *OBE Implementation Committee*  Date:......................................... | **Checked by:**  ---------------------------------  **Dr. Akinul Islam Jony**  *Head (Undergraduate Program) Department of Computer Science*  Date:......................................... |
| **Verified by:**  ....................................................  **Dr. Md. Abdullah-Al-Jubair**  *Director*  *Faculty of Science & Information Technology*  Date:.......................................... | **Certified by:**  .....................................................  **Prof. Dr. Dip Nandi**  *Associate Dean*,  *Faculty of Science & Information Technology*  Date:............................................ | **Approved by:**  .........................................................  **Mr. Mashiour Rahman**  *Dean*,  *Faculty of Science & Information Technology*  Date:............................................... |