Course Syllabus

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| **Course Title** | Mathematics for Artificial Intelligence | **CRN**  (Course Reference Number) | EE5102 |
| **Subtitle** | - | **Credit** **hour**  (Lecture hours – Lab hours – Credit hours) | 3-0-3 |
| **Course Format** | Lecture ■ Discussion □ Laboratory □ Practicum □  Blended □ Online □ (Add)\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | |
| **Course Description** | Learn mathematics that form the foundations of computer science and artificial intelligence. The class will introduce mathematical concepts that include finite automata, non-determinism, regular expression, CFL (Context-Free Language), Turing machine, decidability, reducibility and complexity theory. In addition, selected topics in advanced linear algebra and probabilistic methods will be discussed. | | |

**P1. Course Information**

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| **Instructor** | Prof. Chong-Kwon Kim | **Office** | The Class 538 | |
| **Office Hours** | *9:00AM TO 10:00 AM on Fridays*  TBD | **Office Telephone** | 061-330-9654 | |
| **E-mail** | ckim@kentech.ac.kr | |
| **Discipline** | Energy AI | **Prerequisite** | - C language, introductory linear algebra, introductory probability | |
| **Target Audience** | Graduate Students |
| **Course Reading & Resources** | | | | |
| **Required Materials** | Introduction to the theory of computation, 3rd Ed., Michael Sipster  Int. to Probability, D. Berteskas & J. Tsitsiklis  Int. to Linear Algebra, G. Strang | | | |
| **Other Recommended Materials (optional)** |  | | | |
| **Course Access** | This is an offline course. However, it may be changed to an on-line course if the situation due to COVID-19 does not allow off-line meeting. | | |
| **Technical & Academic Support** | If you need any technical/academic assistance at any time during the course, please contact your instructor and/or course TA  - Instructor: Prof. Chong-Kwon Kim  - Course Teaching Assistant: TBD | | |

**P2. Course Objectives**

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| **Course Learning Objectives** | Through this course you will:  - Understand theoretical foundation of computation  - Forster the capability to apply mathematical techniques to various problems in computer science and artificial intelligence |
| **Course Learning Activities** | To meet the objectives, you will:  - Read required reading materials every week  - Weekly simple check-in tests to check the progress |

**P3. Topic Outline/Schedule**

**Important note**: Refer to the course calendar for specific dates and times. Activity and assignment details will be explained in detail within each week’s corresponding learning module. If you have any questions, please contact your instructor.

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| **Module 01**  **(Week 01~04)** |  | | |
| **Week 01** | **Boolean logic** | Introductory mathematics |
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| **Week 02** | **Regular language** | Finite automata, Non-determinism |
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| **Week 03** | **Regular language 2** | Regular expression, nonregular languages |
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| **Week 04** | **Context Free Language** | Context Free Grammars, pushdown automata |
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| **Module 02**  **(Week 05~07*)*** |  | | |
| **Week 05** | **The Church-Turing Thesis** | Turing machines, variants of Turing machines |
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| **Week 06** | **Decidability** | Decidable language, undecidability |
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| **Week 07** | **Ruducibility** | Mapping reducubility |
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| **Module 03**  **(Week 08~09)** | **Optoelectronic Devices** | | |
| **Week 08** | **Summary and Midterm** |  |
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| **Week 09** | **Basic probability** | Conditional probability and Bayes’ theory |
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| **Module 04**  **(Week 10~15)** |  | | |
| **Week 10** | **Discrete Random Variables** | Bernoulli, Poisson and Geometric |
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| **Week 11** | **Continuous Random Variables** | Joint distribution, Gaussian and Multivariate Gaussian |
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| **Week 12** | **Inference** | MLE, MAP |
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| **Week 13** | **Linear algebra basics** | Basis, space, orthogonality and projection |
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| **Week 14** | **Basic decomposition** | Inversion, LU/QR decomposition |
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| **Week 15** | **SVD** | SVD |
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| - | **Week 16** | **Final Exam.** |  |
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**P4. Grading Policy**

Graded Course Activities

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| **Activity** | **Percentage** |
| Participation | 15 |
| Check-in test | 15 |
| Midterm | 35 |
| Final Exam | 35 |
| **Total** | **100%** |