|  |  |  |
| --- | --- | --- |
| المملكة العربية السعودية  وزارة التعليم العالي  **جامعة أم القرى**  الكلية الجامعية بالجموم – قسم الحاسب الآلي |  | Kingdom of Saudi Arabia  Ministry of Higher Education  **Umm Al-Qura University**  University College in Al-Jamoum  Computer Dept. |

Course Specification

1. **Course number and name:** (2316415-3) Theory of Computing
2. **Credits and contact hours:** 3 Credits

(Lecture: 3/week – Practical Session: Non)

1. **Instructor’s or course coordinator’s name:** Dr. Abdel-Rahman Hedar
2. **Text books**
3. **Main Text book:** Michael Sipser, Introduction to the Theory of Computation, 3rd Edition, Cengage Learning, 2012.
4. **Reference:** Elaine Rich, Automata, computability and complexity: theory and applications. Upper Saddle River: Pearson Prentice Hall, 2008.
5. **Specific course information**
6. **brief description of the content of the course (Catalog Description):**

Upon the completion of this course, the student will have learned, through appropriate classroom lectures, what are the fundamental capabilities and limitations of computers, which problems can or cannot be computed, and how quickly can a problem be computed.

1. **prerequisites or co-requisites:** File Processing and Organization (2316327-3)

Programming Languages (2316331-4)

1. **indicate whether a required, elective, or selected elective course in the program:** required
2. **Specific goals for the course**

The student will be able to:

1. Analyze and design finite automata, pushdown automata, Turing machines, formal languages, and grammars.
2. Demonstrate their understanding of key notions, such as algorithm, computability, decidability, and complexity through problem solving.
3. Prove the basic results of the Theory of Computation.
4. Explain the relevance of the problem complexity.

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Course*  *Goals* | *Program Outcomes* | | | | | | | | | | |
| SOa | SOb | SOc | SOd | SOe | SOf | SOg | SOh | SOi | SOj | SOk |
| 1 | **🗸** | **🗸** | **🗸** |  |  |  |  |  |  | **🗸** |  |
| 2 | **🗸** |  |  |  |  |  |  |  |  |  |  |
| 3 | **🗸** |  |  |  |  |  |  |  |  | **🗸** |  |
| 4 | **🗸** | **🗸** | **🗸** |  |  |  |  |  |  | **🗸** |  |

|  |  |
| --- | --- |
| **Relationship of Course Goals to the Program Student Outcomes** | |
| **SOa** | An ability to apply knowledge of computing and mathematics appropriate to the discipline   * *Students will understand the theoretical foundations of the discipline.* |
| **SOb** | An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution.   * *On theoretical level, students will be able to see which problems can be solved on which model.* |
| **SOc** | An ability to design, implement and evaluate a computer-based system, process, component, or program to meet desired needs.   * *Students will be able to model computational problems using finite state machines and push down automata.* |
| **SOj** | An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.   * *This course provides mathematical foundations of computing.* |

1. **Brief list of topics to be covered**

* Introduction
* Finite Automata
* Regular Languages
* Context-Free Languages
* Turing Machines
* Complexity
* P and NP Problems