**Course Description Form**

# Description of the location

This course description provides a concise summary of the main features of the course and the learning outcomes expected of the student, demonstrating whether the student has made the most of the available learning opportunities. It must be linked to the course description. The program.

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| Shatt al-Arab University | 1 . Educational institution |
| Computer Science | 2 . Scientific Department / Center |
| Computational Theory / **CS205** | 3 . Name/Code of the headquarters |
| My presence | 4 . Available forms of attendance |
| Second semester/ 2024-2025 | 5 . semester/year |
| 125 | 6 . Number of study hours (total) |
| August 5, 2025 | 7 . Date this description was prepared |
| 8 . Course objectives  course aims to introduce students to the core field of computer science, enabling them to focus on the study of abstract computational models . These abstract models allow students to evaluate, through logical reasoning, what computation can achieve when used to solve science and engineering problems . This course aims to enable them to answer fundamental questions about problems, such as whether they are computable . The course introduces basic computational models and their properties. Students will be able to express computer science problems as mathematical statements and formulate proofs. | |

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| 9. Course outcomes, teaching, learning and assessment methods  A- Knowledge and understanding :  - Clarifying the basic concepts in computing theory through a set of tools .  - Acquire problem-solving skills .  - Acquire basic skills as an introduction to language building .  - Acquire theoretical concepts for dealing with machine learning mechanisms, functional expression mechanisms (DFA) , non-functional functional expression mechanisms (NFA) , stack mechanisms , Turing machines, and rules .  - B- Subject-specific skills :  1- The ability to design (functional expression mechanisms, non-functional functional expression mechanisms, grammar, language modeling, and the basics of small compilers) .  2- The ability to think about solving the problem according to specific rules.  3- Writing scientific reports .  4- Knowing the comparison between (natural and formal languages). |
| A- Cognitive objectives  , computational theory is defined as the branch of study that studies whether and how problems can be efficiently solved using a computational model and algorithm. This field is divided into three main branches: automata theory, computability theory, and computational complexity theory .  theory is to develop a formal mathematical model of computing that reflects reality .  Computers .  The student can review these basic topics to guide him in the field of computational theory. These topics are: (computational theory, language concepts, grammar concepts, finite state machines, deterministic finite automata, non-deterministic finite state machines, regular languages, regular expressions, pumping theorem, free grammars, FSM summary , free languages, ambiguity). |
| B-Skill objectives of the course  - Readings, self-learning, discussion groups .  - Classroom exercises and activities .  - Directing students to some websites to benefit from them in developing their skills .  - Holding research seminars to explain and analyze some problems and the mechanism for finding solutions .  Write something like: The main strategy used in teaching this unit is to encourage students to participate in exercises, while honing and expanding their critical thinking skills. This will be achieved through classroom instruction, interactive lessons, and the study of simple experiments that include some sample activities that interest the students. |
| Teaching and learning methods |
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| Evaluation methods |
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| C- Emotional and value goals |
| Teaching and learning methods |
| |  |  |  | | --- | --- | --- | | **Learning and Teaching Resources**  sources learning and teaching | | | |  | **Text** | **Available in the**  **Library?** | | **Required Texts** | ( Michael (Sipser), Introduction to the Theory of computation  (Third Edition ). | Yes | | **Recommended Texts** | Theory of Computation Simplified , ( Varsha H. Patil ,  Vaishali S. Pawar Swati​ A. Bhavsar) , 2022 . | No | | **Websites** | https://elc.uobasrah.edu.iq/enrol/index.php?id=72 | | |
| Evaluation methods |
| |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **Module Evaluation**  evaluation The material Academic | | | | | | |  | | **Time/Nu**  **amber** | **Weight (Marks)** | **Week Due** | **Relevant Learning**  **Outcome** | | **Formative assessment** | **Quizzes** | 2 | 10% (10) | 5, 10 | LO #1, 2, 10 and 11 | | **Assignments** | 2 | 10% (10) | 2, 12 | LO # 3, 4, 6 and 7 | | **Projects / Lab.** | 1 | 10% (10) | Continuous |  | | **Report** | 1 | 10% (10) | 13 | LO # 5, 8 and 10 | | **Summative**  **assessment** | **Midterm Exam** | 2 hours | 10% (10) | 7 | LO # 1- 7 | | **Final Exam** | 2 hours | 50% (50) | 16 | All | | **Total assessment** | | | 100% (100 Marks) |  |  | |
| D - General and transferable skills ( other skills related to employability and personal development ) .  1-  2-  3-  4- |
| 10. Course structure |

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|  | Learning method | Unit name/topic | Required learning outcomes | watches | week |
|  | In-person lecture  Reports  project  Quick test | -- General information about computing .  - Information representation .  - Arithmetic problems .  - Properties of arithmetic problems  - Computational theory |  | 8 | the first |
|  | In-person lecture  Reports  project  Quick test | - Language concepts  - Grammar concepts  Chomsky's classification of grammar  Finite state machine  - How does the machine work? |  | 8 | the second |
|  | In-person lecture  Reports  project  Quick test | - A machine's view of the finite state machine  - How to define a finite state machine  Finite state machine diagrams  - Properties of a state machine  Deterministic finite state machine ( DFA )  - Examples of finite state machine. |  | 8 | the third |
|  | In-person lecture  Reports  project  Quick test | Nondeterministic finite state machine ( NFA )  - Running a finite state machine ( NFA )  Examples of non-deterministic finite state machines  8 - Finite State Machine vs. Non-Deterministic Finite State Machine |  | 8 | Fourth |
|  | In-person lecture  Reports  project  Quick test | Machine equivalence  Example of equivalent machines  Proof by construction |  | 8 | Fifth |
|  | In-person lecture  Reports  project  Quick test | - Properties of regular languages  Definition of regular languages  - The union process and examples of it  - The sequencing process and examples of it  - Star process and examples |  | 8 | Sixth |
|  | In-person lecture  Reports  project  Quick test | - Properties of regular languages  Definition of regular languages  - The union process and examples of it  - The sequencing process and examples of it  - Star process and examples |  | 8 | Seventh |
|  | In-person lecture  Reports  project  Quick test | - DFA minimization  - Equivalence theory  - Equivalent DFA plot  - Minimize the way to fill out the DFA table |  | 8 | The eighth |
|  | In-person lecture  Reports  project  Quick test | - Myhill-Nerod theory  Regular languages and examples  Regular expressions and examples |  | 8 | Ninth |
|  | In-person lecture  Reports  project  Quick test | - Automata theory (basics, inferences, priority of operators, examples, identities, facts)  - RE parity and automata. |  | 8 | tenth |
|  | In-person lecture  Reports  project  Quick test | - Convert RE to ε-NFA  - Constructing the ε-NFA formula  - Convert RE to ε-NFA : (union, concatenation, closure, examples)  - Convert DFA to RE  - Algebraic laws of RE |  | 8 | eleventh |
|  | In-person lecture  Reports  project  Quick test | Converting automata to regular expressions using case deletion  Pumping the theorem  - Converting the theory into a regular proof language  - Converting the theory into an irregular proof language  Pigeonhole Principle and FSA |  | 8 | twelfth |
|  | In-person lecture  Reports  project  Quick test | - Theory - Long chains  - Line of reasoning  Examples of pumping the theorem |  | 8 | thirteenth |
|  | In-person lecture  Reports  project  Quick test | Free Grammar  FSM Summary  - Free languages  Chomsky's sequence |  | 8 | fourteenth |
|  | In-person lecture  Reports  project  Quick test | - Derivation of free languages  - Derivation trees, examples  - Ambiguity, examples |  | 8 | fifteenth |
|  | In-person lecture | Preparatory week before the final exam |  | 5 | sixteenth |

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| 11. Infrastructure | |
| 1- Required textbooks | nothing | |
| 2- Main references (sources) | Computational Theory - Dr. Abdul-Hussein Mohsen, University of Basra | |
| a) Recommended books and references (scientific journals, reports, etc.) | (Michael Sipser), Introduction to the Theory of computation  (Third Edition).  Theory of Computation Simplified, (Varsha H. Patil ,  Vaishali S. Pawar , Swati A. Bhavsar), 2022. | |
| b) Electronic references , websites, etc. |  | |

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| 12. Curriculum development plan |
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