**COURSE PLAN**

|  |  |
| --- | --- |
| Target | 45% (marks) |
| Level-1 | 35% (population) |
| Level-2 | 45% (population) |
| Level-3 | 55% (population) |

1. **Method of Evaluation**

|  |  |
| --- | --- |
| **UG** | **PG** |
| Quizzes/Tests, Assignments (30%) | Quizzes/Tests, Assignments, seminar (50%) |
| Mid Examination (20%) | End semester (50%) |
| End examination (50%) |  |

1. **Passing Criteria**

|  |  |  |
| --- | --- | --- |
| **Scale** | **PG** | **UG** |
| **Out of 10 point scale** | SGPA – “6.00” in each semester  CGPA – “6.00”  Min. Individual Course Grade  –  “C”  Course Grade  Point –  “4.0” | SGPA – “5.0” in each semester  CGPA – “5.0”  Min. Individual Course Grade  –  “C”  Course Grade  Point –  “4.0” |

\*for PG, passing marks are 40/100 in a paper

\*for UG, passing marks are 35/100 in a paper

1. **Pedagogy**

* Fully Online
* Blackboard Collaborate synchronous sessions (70%)
* Blackboard LMS for asynchronous sessions (30%)
* Online Assessment (Quizzes, Class Test, Assignment)
* Non-Gradable assessments/feedback

1. **References:**

|  |  |  |  |
| --- | --- | --- | --- |
| Text Books | Web resources | Journals | Reference books |
| T1: John E. Hopcroft, Jeffery Ullman,”Introduction to Automata theory Languages & Narosa computation” Publishers.  T2: K.L.P Mishra & N. Chandrasekaran,“Theory of Computer Science”, PHI Learning. | 1. http://www.cse.iitb.ac.in/~trivedi/courses/cs208/lecture01.pdf 2. http://www.cse.iitd.ernet.in/~sak/courses/toc/toc-recursive-function-theory.pdf 3. http://textofvideo.nptel.iitm.ac.in/106106049/lec1.pdf | - | R1: John C Martin, “Introduction to languages and theory of Computation”, McGraw Hill.  R2: Daniel I.A. Cohen, “Introduction to Computer Theory”, Wiley India.  R3: Kohavi, ”Switching & Finite Automata Theory”, TMH |

**GUIDELINES TO STUDY THE SUBJECT**

**Instructions to Students:**

1. Go through the 'Syllabus' in the Black Board section of the web-site (https://learn.upes.ac.in) in order to find out the Reading List.
2. Get your schedule and try to pace your studies as close to the timeline as possible.
3. Get your on-line lecture notes (Content, videos) at Lecture Notes section.  These are our lecture notes. Make sure you use them during this course.
4. Check your blackboard regularly
5. Go through study material
6. Check mails and announcements on blackboard
7. Keep updated with the posts, assignments and examinations which shall be conducted on the blackboard
8. Be regular, so that you do not suffer in any way
9. **Cell Phones and other Electronic Communication Devices:** Cell phones and other electronic communication devices (such as Blackberries/Laptops) are not permitted in classes during Tests or the Mid/Final Examination. Such devices MUST be turned off in the class room.
10. **E-Mail and online learning tool:** Each student in the class should have an e-mail id and a pass word to access the LMS system regularly. Regularly, important information – Date of conducting class tests, guest lectures, via online learning tool. The best way to arrange meetings with us or ask specific questions is by email and prior appointment. All the assignments preferably should be uploaded on online learning tool. Various research papers/reference material will be mailed/uploaded on online learning platform time to time.
11. **Attendance:** Students are required to have minimum attendance of 75% in each subject. Students with less than said percentage shall NOT be allowed to appear in the end semester examination.

This much should be enough to get you organized and on your way to having a great semester! If you need us for anything, send your feedback through e-mail *amit.singh1@ddn.upes.ac.in*. Please use an appropriate subject line to indicate your message details.

There will no doubt be many more activities in the coming weeks. So, to keep up to date with all the latest developments, please keep visiting this website regularly.

**RELATED OUTCOMES**

1. **The expected outcomes of the Program are:**

|  |  |
| --- | --- |
| PO1 | **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. |
| PO2 | **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. |
| PO3 | **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. |
| PO4 | **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. |
| PO5 | **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations. |
| PO6 | **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice. |
| PO7 | **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. |
| PO8 | **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. |
| PO9 | **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. |
| PO10 | **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. |
| PO11 | **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments. |
| PO12 | **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. |

1. **The expected outcomes of the Specific Program are:**

|  |  |
| --- | --- |
| PSO1 | Perform system and application programming using computer system concepts, concepts of Data Structures, algorithm development, problem solving and optimizing techniques, |
| PSO2 | Apply software development and project management methodologies using concepts of front-end and back-end development and emerging technologies and platforms. |
| PSO3 | To create & develop the most efficient solutions by applying machine learning with an analytical emphasis on industrial and research problems. |

1. **The expected outcomes of the Course are:**

|  |  |
| --- | --- |
| CO 1 | Apply formal mathematical methods to prove properties of languages, grammars and automata. |
| CO 2 | Design finite state machines for acceptance of strings. |
| CO 3 | Design context free grammars and push down automata for formal languages. |
| CO 4 | Construct Turing machine and distinguish between decidability and undecidability. |

1. **Co-Relationship Matrix**

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Program**  **Outcomes**  **Course Outcomes** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| **CO 1** | 1 | 2 | 2 |  |  |  |  |  |  |  |  |  |  |  |  |
| **CO 2** | 1 | 2 | 2 |  |  |  |  |  |  |  |  |  |  |  |  |
| **CO3** | 1 | 2 | 2 |  |  |  |  |  |  |  |  |  |  |  |  |
| **CO4** | 2 | 2 |  | 2 |  |  |  |  |  |  |  | 2 |  |  |  |
| **Etc.** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Average** | 1.25 | 2 | 1.5 | 0.5 |  |  |  |  |  |  |  | 0.5 |  |  |  |

1. **Course outcomes assessment plan:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **components**  **Course Outcomes** | **Assignment** | **Test/Quiz** | **Mid Semester** | **End Semester** | **Any other** |
| **CO 1** | **🗸** | **🗸** | **🗸** | **🗸** | **□** |
| **CO 2** | **🗸** | **🗸** | **🗸** | **🗸** | **□** |
| **CO 3** | **🗸** | **🗸** | **🗸** | **🗸** | **□** |
| **CO 4** | **🗸** | **🗸** | **□** | **🗸** | **□** |
| **CO 5** | **🗸** | **🗸** | **□** | **🗸** | **□** |

**BROAD PLAN OF COURSE COVERAGE**

**Course Activities:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S. No.** | **Description** | **Planned** | | | **Remarks** |
| **From** | **To** | **No. of Sessions** |
| **1.** | **UNIT 1: Introduction to Finite Automata** | L1 | L5 | 5 |  |
| **2.** | **UNIT 2: Nondeterministic finite Automata (NFA), Deterministic Finite Automata**  **(DFA)** | L6 | L12 | 07 | Quiz 1 |
| **3.** | **UNIT 3: Regular Expressions (RE)Regular Languages, Context Free Grammar (CFG)** | L13 | L20 | 08 | Class Test 1, Assignment 1  MID Semester Examination |
| **4.** | **UNIT 4: Push Down Automata (PDA)** | L21 | L25 | 05 | Quiz 2 |
| **5.** | **UNIT 5: Turing Machine TM** | L26 | L30 | 05 | Class Test 2 |
| **6.** | **UNIT 6: Undecidability & Recursively Enumerable Language** | L31 | L36 | 06 | Assignment 2 |

Sessions: Total No. of Instructional periods available for the course

**SESSION PLAN**

**UNIT-I**

|  |  |  |
| --- | --- | --- |
| **Lecture No.** | **Topics to be Covered** | **CO Mapped** |
| 1 | Introduction to defining language, automata | CO1 |
| 2 | Kleene closures | CO1 |
| 3 | Finite Automata (FA) | CO1 |
| 4 | Construction of FA Machines | CO1 |
| 5 | Transition graph, generalized transition graph | CO1 |

**SESSION PLAN**

**UNIT-II**

|  |  |  |
| --- | --- | --- |
| **Lecture No.** | **Topics to be Covered** | **CO Mapped** |
| 6 | Construction of NFA, DFA | CO1 |
| 7 | Construction of NFA with E-moves | CO1 |
| 8 | NFA with E-moves to without E-moves | CO1 |
| 9 | NFA to DFA Conversion | CO1 |
| 10 | Minimization of Automata | CO1 |
| 11 | Finite State Transducer: Moore machine, Mealy machine | CO2 |
| 12 | Applications of Moore and Mealy Machines, Limitations of FA | CO2 |

**SESSION PLAN**

**UNIT-III**

|  |  |  |
| --- | --- | --- |
| **Lecture No.** | **Topics to be Covered** | **CO Mapped** |
| 13 | Introduction to Regular Expressions (RE) and Regular Languages. | CO2 |
| 14 | Equivalence of FA With RE | CO2 |
| 15 | Grammar Classification | CO2 |
| 16 | Arden Theorem | CO2 |
| 17 | Pumping Lemma for regular expressions | CO2 |
| 18 | Myhill-Nerode theorem | CO2 |
| 19 | Context free grammar : Ambiguity, Simplification of CFGs | CO3 |
| 20 | Normal forms for CFGs, Pumping Lemma for CFLs, Decidability of CFGs, Ambiguous to Unambiguous CFG | CO3 |

**SESSION PLAN**

**UNIT-IV**

|  |  |  |
| --- | --- | --- |
| **Lecture No.** | **Topics to be Covered** | **CO Mapped** |
| 21 | Description and definition | CO3 |
| 22 | Working of PDA, Acceptance of a string by PDA,PDA and CFG | CO3 |
| 23 | Introduction to auxiliary PDA | CO3 |
| 24 | Two stack PDA | CO3 |
| 25 | Pumping Lemma | CO3 |

**SESSION PLAN**

**UNIT-V**

|  |  |  |
| --- | --- | --- |
| **Lecture No.** | **Topics to be Covered** | **CO Mapped** |
| 26 | Basic model, definition | CO4 |
| 27 | Representation, Language acceptance by TM | CO4 |
| 28 | TM and type 0 grammar | CO4 |
| 29 | Halting problem of TM, Modifications in TM | CO4 |
| 30 | Universal TM | CO4 |
| 31 | Language accepted by TM, Role of TM, Design of TM. | CO4 |

**SESSION PLAN**

**UNIT-VI**

|  |  |  |
| --- | --- | --- |
| **Lecture No.** | **Topics to be Covered** | **CO Mapped** |
| 32 | Properties of recursive and recursively enumerable languages. | CO4 |
| 33 | Unsolvable decision problem, Empty and Non  Empty language, rice theorem | CO4 |
| 34 | Undecidability of Post correspondence problem | CO4 |
| 35 | Church’s Thesis, Recursive function theory, | CO4 |
| 36 | Gödel Numbering. | CO4 |

\* Session marked with yellow Shade will be conducted in ***Asynchronous*** mode using Blackboard LMS. All other sessions will be in ***Synchronous*** mode using Blackboard Collaborate.