| Course code | Course Title | L | T | P | C |
|---|---|---|---|---|---|
| BITE306L | Theory of Computation | 3 | 1 | 0 | 4 |
| Pre-requisite | BMAT205L | Syllabus version | | | |
| | | 1.0 | | | |

**Course Objectives:**

1. To introduce the mathematical foundations of computation
2. To develop mathematical proofs for computation and algorithms.
3. To prepare students in automation theory, formal languages, algorithms & logic.

**Course Outcomes:**

1. Analyze the deterministic finite machine and non-deterministic finite automata to accept the languages.
2. Use and apply important properties of finite automaton to derive regular expressions from finite automation and vice versa.
3. Analyze the context free grammar to simplify, remove ambiguity and perform conversion.
4. Design push down automata for information technology related applications and to perform. Conversion between context free grammar and push down automation.
5. Design unrestricted and context sensitive grammar for information technology related applications, and linear bounded automata for context sensitive languages.
6. Design Turing machine for information technology related applications; demonstrate the knowledge of decidability and undecidability.

| Module:1 | Deterministic Finite Automata (DFA) | 8 hours |
|---|---|---|

Chomsky hierarchy of languages- Introduction to Finite automata (FA) and examples – Language acceptance and string acceptance by a DFA - Closure Properties - Minimization of finite automata - Regular languages - Non regular languages.

| Module:2 | Non- Deterministic Finite Automata(NFA) | 9 hours |
|---|---|---|

Introduction and examples - Conversion from DFA to NFA Finite Automata with Epsilon transitions - Equivalence of NFA and DFA - FA with output-Moore and mealy machine.

| Module:3 | Regular Expression (RE) | 8 hours |
|---|---|---|

Recursive definition of regular expression - Regular Set-Identities of RE - Equivalence of RE-Identity Rules -Inter Conversion RE and FA, Pumping lemma.

| Module:4 | Context-free Grammar (CFG) | 9 hours |
|---|---|---|

Introduction - Definition, right linear grammar - left linear grammar - Conversion from right linear grammar to left linear grammar - Derivation and ambiguity - Simplification of CFG - Normal forms

| Module:5 | Push down automata (PDA) | 8 hours |
|---|---|---|

Definition - Construction of pushdown automata - Equivalence of push down automata and context-free grammar.

| Module:6 | Context Sensitive and Unrestricted Grammars | 8 hours |
|---|---|---|

Unrestricted Grammar - Definition, Examples - Context-Sensitive Grammars and Languages - Definition, Examples, Linear Bounded Automata

| Module:7 | Turing machine (TM) and Decidability | 8 hours |
|---|---|---|

Definition - Design of Turing machine - Types of Turing machines - Introduction to Context sensitive grammar and languages - Linear bounded automata.

Decidable Languages - Decidable problems concerning regular languages, Decidable problems concerning context-free languages Undecidability: The diagonalization method - Recursively enumerable and recursive languages - Undecidable problems - Halting and PCP problem - A Turing-unrecognizable language - Halting problem is undecidable.

| | | |
|---|---|---|
| **Module:8** | **Contemporary Issues** | **2 hours** |
| | | |
| | **Total Lecture hours:** | **60 hours** |

| | |
|---|---|
| **Text Book** | |
| 1. | Peter Linz, Jones & Bartlet, “Introduction to Formal Languages and Automata”, 2016, 6th Edition, Jones & Bartlett. |
| **Reference Books** | |
| 1. | John E. Hopcroft, “Introduction to Automata Theory, Languages and Computation”, 2014, 3rd Edition, Pearson Education. |
| 2. | Michael Sipser, “Introduction to the Theory of Computation”, 2014, 3rd Edition, Cengage Publisher. |

| | | | |
|---|---|---|---|
| Mode of Evaluation: Continuous Assessment Tests, Assignment, Quiz, Final Assessment Test | | | |
| Recommended by Board of Studies | 20-05-2022 | | |
| Approved by Academic Council | No. 66 | Date | 16-06-2022 |