Code No. MCA 201 **L T C**
Paper: Theory of Computation **3 1 4**

INSTRUCTIONS TO PAPER SETTERS:

1. Question No. 1 should be compulsory and cover the entire syllabus. There should be 10 questions of short answer type of 2 marks each, having at least 2 questions from each unit.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions to evaluate analytical/technical skills of candidate. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks including subparts, if any.

OBJECTIVES:

This course is extensive and theoretical treatment of issues in Computability and Complexity; Topics include Automata and Language Theory, Computability Theory, and Complexity Theory. Learning outcome of this course will be theoretical treatment of following

- *What can be computed and how fast it can be done?*
- *Use of Automata and Language theory in the development of different modules of a compiler as a case study.*

PRE-REQUISITE:

- Discrete Mathematics
- Skills in writing Formal Mathematical Proofs

UNIT - I

Automata and Language Theory: Overview of Theoretical Computer Science (including computationally intractable problems) , Introduction to System software including various phases / Modules in the design of a typical compiler , Chomsky Classification, Finite Automata, Deterministic Finite Automata (DFA), Non-Deterministic Finite Automata (NFA),statement of Kleen's Theorem, Regular Expressions, Equivalence of DFAs, NFAs and Regular Expressions, Closure properties of Regular Language, Non-Regular Languages, Pumping Lemma. Myhill Nerode Theorem, Use of Regular expressions in the Design of scanner (lexical analyzer). Introduction to JFLAP Simulation. **[No. of Hr: 12]**

UNIT - II

Context Free Languages: Context Free Grammar (CFG), Parse Trees, Push Down Automata (deterministic and nondeterministic) (PDA), Equivalence of CFGs and PDAs, Closure properties of CFLs, Pumping Lemma, Parsing (including LL(1) , SLR and LR(1) Parsing Method).

[No. of Hr.: 12]

UNIT - III

Turing Machines and Computability Theory: Definition of Turing Machine, Extensions of Turing machines, Non – deterministic Turing machines, Equivalence of various Turing Machine Formalisms, Church – Turing Thesis, Decidability, Halting Problem, Reducibility, Recursion Theorem. **[No. of Hr: 10]**

UNIT - IV

Complexity Theory: Time and Space measures, Hierarchy theorems, Complexity classes P, NP, space complexity , Savich theorem , L, NL, PSPACE complexity , Post correspondence problem, Probabilistic computation.

[No. of Hr: 6]

TEXT BOOKS:

1. J. C. Martin, "Introduction to Languages and the Theory of Computation", TMH, 3rd Ed. 2007.

2. M. Sipser, "Introduction to the Theory of Computation", Cengage Publication, 2006.
3. J. Hopcroft, R. Motwani, and J. Ullman, "Introduction to Automata Theory, Language and Computation", Pearson, 2nd Ed., 2006.
4. Wayne Goddard, "Introducing the Theory of Computation", Jones & Bartlett Student Ed.

REFERENCES:

1. Dexter C. Kozen "Theory of Computation ", Springer 2006.
2. H. R. Lewis and C. H. Papadimi Triou, "Elements of the Theory of Computation", Pearson, 2nd Ed., 1997.
3. D. Cohen, "Introduction to Computer Theory, Wiley, N. York, 2nd Ed., 2008.
4. K. L. Mishra and N. Chandrasekharan, "Theory of Computer Science Automata Language Computation", PHI, 3rd Ed., 2007.
5. Susan H. Rodger, "JFLAP: An interactive Formal Languages and Automata Package", Jones & Bartlett, 2009.
6. Peter Linz, "Introduction to Formal Languages and Automata", Narosa.
7. Sudkamp, "Languages and Machines", Pearson Education, 2007.
8. Bernard Moret, "Theory of Computation", Pearson Education, 2008.