GUJARAT TECHNOLOGICAL UNIVERSITY

COMPUTER ENGINEERING (07)
THEORY OF COMPUTATION
SUBJECT CODE:2160704
B.E. 6thSEMESTER

Type of course: Core

Prerequisite: Calculus, Data Structures and Algorithms

Rationale: Theory of computation teaches how efficiently problems can be solved on a model of computation, using an algorithm. It is also necessary to learn the ways in which computer can be made to think. Finite state machines can help in natural language processing which is an emerging area.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks			Practical Marks			
				ESE (E)	PA (M)		ESE (V)		PA (I)	
					PA	ALA	ESE	OEP		
3	0	0	3	70	20	10	0	0	0	100

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Review of Mathematical Theory**: Sets, Functions, Logical statements, Proofs, relations, languages, Mathematical induction, strong principle, Recursive definitions	**10**	16
2	**Regular Languages and Finite Automata:** Regular expressions, regular languages, applications, Automata with output-Moore machine, Mealy machine, Finite automata, memory requirement in a recognizer, definition, union, intersection and complement of regular languages.Non Determinism Finite Automata, Conversion from NFA to FA, ∧- Non Determinism Finite Automata Conversion of NFA- ∧ to NFA and equivalence of three Kleene's Theorem, Minimization of Finite automata Regular And Non Regular Languages – pumping lemma.	**12**	20
3	**Context free grammar (CFG):** Definition, Unions Concatenations And Kleen's of Context free language Regular grammar, Derivations and Languages, Relationship between derivation and derivation trees, Ambiguity Unambiguous CFG and Algebraic Expressions BacosNaur Form (BNF), Normal Form – CNF	**12**	20
4	**Pushdown Automata, CFL And NCFL:** Definition, deterministic PDA, Equivalence of CFG and PDA, Pumping lemma for CFL, Intersections and Complements of CFL, Non-CFL	**12**	20
5	**Turing Machine (TM):** TM Definition, Model Of Computation And Church Turning Thesis, computing functions with TM, Combining TM, Variations Of TM, Non Deterministic TM, Universal TM, Recursively and Enumerable Languages, Context sensitive languages and Chomsky hierarchy	**12**	20

6	**Computable Functions:** Partial, total, constant functions, Primitive Recursive Functions, Bounded Mineralization, Regular function, Recursive Functions	2	4

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15	**25**	**25**	**5**	**00**	**00**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. An introduction to automata theory and formal languages By Adesh K. Pandey, Publisher: S.K. Kataria& Sons
2. Introduction to computer theory By Deniel I. Cohen , Joh Wiley & Sons, Inc
3. Computation: Finite and Infinite By Marvin L. Minsky Prentice-Hall
4. Compiler Design By Alfred V Aho, Addison Weslley
5. Introduction to the Theory of Computation By Michael Sipser
6. Automata Theory, Languages, and Computation By John Hopcroft, Rajeev Motowani, and Jeffrey Ullman

Course Outcome:

After learning the course the students should be able to:

1. At the end of the course the students will be able to understand the basic concepts and application of Theory of Computation.
2. Students will apply this basic knowledge of Theory of Computation in the computer field to solve computational problems and in the field of compiler also.

List of Open Source Software/learning website:

1. http://en.wikipedia.org/wiki/Theory_of_computation
2. http://meru.cecs.missouri.edu/courses/cecs341/tc.html

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.