هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

T-104
2022

Course Specification

Course Title: **Theory of Computation**	
Course Code: **535 COMP-3**	
Program: **Bachelor in Computer Science**	
Department: **Computer Science**	
College: **College of Engineering and Computer Science**	
Institution: **Jazan University**	
Version: **V2**	
Last Revision Date:	

Table of Contents:

A. General information about the course:

Course Identification	
1. Credit hours:	3
2. Course type	
a.	University ☐ College ☐ Department☒ Track☐ Others☐
b.	Required ☒ Elective☐
3. Level/year at which this course is offered:	Level-9/yeas-5

4. Course general Description

This course provides students with an understanding of basic concepts in the theory of computation. This module introduces the theory of computation through a set of abstract machines that serve as models for computation - finite automata, pushdown automata, and Turing machines - and examines the relationship between these automata and formal languages. Additional topics beyond the automata classes themselves include deterministic and nondeterministic machines, regular expressions, context free grammars, undecidability, and the P = NP question.

5. Pre-requirements for this course (if any):

None

6. Co- requirements for this course (if any):

None

7. Course Main Objective(s)

- Define languages by abstract, recursive definitions and by regular expressions.
- Construct finite state machines and the equivalent regular expressions.
- Prove the equivalence of languages described by finite state machines and regular expressions.
- Construct pushdown automata and the equivalent context free grammars.
- Construct Turing machines and post machines.
- Determine decidability, finiteness and equivalence properties.

1. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1.	Traditional classroom	44	80%
2.	E-learning		
3.	Hybrid ● Traditional classroom ● E-learning		
4.	Distance learning (Self Learning)	11	20%

2. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	22
2.	Laboratory/Studio	22
3.	Field	
4.	Tutorial	
5.	Others (specify)	8
	Total	52

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	Knowledge and understanding			
1.1	**Describe** languages using Regular Expressions, Finite Automata, Nondeterministic Finite Automata, Mealy Machines, Moore Machines, Context Free Grammars, Pushdown Automata, and Turing Machines ()	K1	Class lectures and lecture notes	Midterm/ Assignment 1 / Final Exam/Final Lab
1.2	**Distinguish** between Regular Languages, Context Free Languages, Recursive Languages, and Recursive Enumerable (or Computable) Languages ()	K1	Class lectures/ lecture notes/ Case studies	Assignment 1 / Final Exam/Final Lab
1.3				
2.0	Skills			
2.1	**Design** finite state machines and the equivalent regular expressions.	S1	Class lectures/ lecture notes/Case studies	Midterm/ Assignment 1 / Final Exam/Final Lab
2.2	**To solve** various problems of applying normal form	S3	Class lectures/ lecture notes/	Final Exam/ Assignments

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	techniques, push down automata and Turing Machines		Case studies / Brainstorming	2/Group Assignments/Lab Exam
2.3	**Design** Turing machines and post machines.	S4	Class lectures/ lecture notes	Final Exam/ Group Assignments / Final Lab
2.4	**Derive** whether a problem is decidable or not.	S2	Class lectures/ lecture notes	Final Exam/ Group Assignments / Final Lab
3.0	Values, autonomy, and responsibility			
3.1	**Demonstrate** the ability to work in group to achieve common assignments and activities in the field of computational theory and Turing machine.	V2	Small group discussion / Brainstorming/ Class discussion to train students to think independently	Group Assignments/ Final Exam
3.2				
...				

C. Course Content

No	List of Topics	Contact Hours
1.	Chapter – 1 INTRODUCTION TO FINITE AUTOMATA Introduction, Deterministic Finite Automata (DFA) -Formal definition, simpler notations (state transition diagram, transition table), language of a DFA. Nondeterministic Finite Automata (NFA)- Definition of NFA, language of an NFA, Equivalence of Deterministic and Nondeterministic Finite Automata, Applications of Finite Automata, Finite Automata with Epsilon Transitions, Eliminating Epsilon transitions, Minimization of Deterministic Finite Automata.	2T + 2P

2.	**Chapter – 2 REGULAR EXPRESSIONS (RE) & REGULAR GRAMMARS:** Introduction, Identities of Regular Expressions, Finite Automata and Regular Expressions- Converting from DFA's to Regular Expressions, Converting Regular Expressions to Automata, applications of Regular Expressions. Definition, regular grammars and FA, FA for regular grammar, Regular grammar for FA. Proving languages to be non-regular -Pumping lemma, applications, Closure properties of regular languages.	4T + 4P
3.	**Chapter – 3 CONTEXT FREE GRAMMAR** Derivation Trees, Sentential Forms, Rightmost and Leftmost derivations of Strings. Ambiguity in CFG's, CNF, Pumping Lemma for CFL's, Enumeration of Properties of CFL (Proof's omitted).	4T + 4P
4.	**Chapter – 4 PUSH DOWN AUTOMATA** Definition, Model, Acceptance of CFL, Acceptance by Final State and Acceptance by Empty stack and its Equivalence, Equivalence of CFG and PDA	2T + 2P
5.	**Chapter-5 TURING MACHINE** Formal definition and behavior, Languages of a TM, TM as accepters, TM as a computer of integer functions, Types of TMs.	3T + 3P
6.	**Chapter – 6 UNSOLVABLE PROBLEMS AND COMPUTABLE FUNCTIONS** Unsolvable Problems and Computable Functions – Primitive recursive functions – Recursive and recursively enumerable languages – Universal Turing machine. MEASURING AND CLASSIFYING COMPLEXITY: Tractable and Intractable problems- Tractable and possibly intractable problems - P and NP completeness - Polynomial time reductions.	2T + 2P
7.	Lab Exam + Revision	2T + 2P
Total		22T+22P

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Midterm Exam	9th week	15%
2.	Assignment I	5th week	10%
3.	Assignment II (Case Study/ Group assignment)	11th week	15%
4.	Lab Exam + Lab Assignment	As per schedule	20%
5.	Final Theory Exam	As per schedule	40%
...			

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	Michael Sipser. Introduction to the Theory of Computation. ISBN 978-0357670583.
Supportive References	● John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman (2007), Introduction to Automata Theory Languages and Computation, 3rdedition, Pearson Education, India. ● H.R.Lewis and C.H.Papadimitriou, ―Elements of the theory of Computation, Second Edition, PHI, 2003. ● J.Martin, ―Introduction to Languages and the Theory of Computation, Third Edition, TMH, 2003
Electronic Materials	● http://nptel.ac.in/courses.php?branch=Comp ● https://www.coursera.org/ ● http://java.sun.com/docs/books/tutorial/ ● http://ssw.jku.at/Misc/CC/
Other Learning Materials	Online tutorial

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	● Classroom equipped with projector, whiteboard, and sufficient seating arrangements. ● Lab with software installed and individual computer terminal for each student.
Technology equipment (projector, smart board, software)	● Whiteboards and projectors for classroom and labs ● Computer Lab equipped with 30 PCs having J2ME platform in Net beans 7.0 ● An active internet connection.
Other equipment (depending on the nature of the specialty)	None

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Indirect (Course evaluation survey form)
Effectiveness of students assessment	CRC / QAU / HoD	Direct (Course reports / result analysis)

Assessment Areas/Issues	Assessor	Assessment Methods
Quality of learning resources	Track leaders / CRC	Indirect (Review, meetings and star rating with suggestions for further modification and improvements)
The extent to which CLOs have been achieved	CRC / QAU	Direct (CLO assessment template further verified at course coordinator, Track leader and QAU level)
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data

COUNCIL /COMMITTEE	DEPARTMENT COUNCIL
REFERENCE NO.	
DATE	15/10/2023