

SCHOOL OF COMPUTER SCIENCE AND ENGINEERING
CONTINUOUS ASSESSMENT TEST - II
WINTER SEMESTER 2024-2025

SLOT: F2+TF2

Programme Name & Branch : B.Tech CSE and Specialization
Course Code and Course Name : BCSE304L Theory of Computation
Faculty Name(s) : Prof.Kannadasan R, Prof. Mohana C M, Prof. Annapurna
Jonnalagadda, Prof. Navamani T M, Prof. Arpan Garai, Prof. Anand Bihari, Prof. Uma Priya D
, Prof. Saravanan R, Prof. Naga Priyadarsini R, Prof. Krishnaraj N, Prof. Gunavathi C, Prof.
Viswanathan P, Prof. Vijayarajan V, Prof. Vishnu Priya A, Prof. Sridevi S, Prof. Prabakaran N,
Prof. Sri Preethaa K R, Prof. Katari Balakrishna
Class Number(s) : VL2024250501656, 1634, 1622, 1628, 1648, 1632,
1644, 1640, 1654, 1642, 1618, 1620, 1616, 1638, 1636, 1624, 1650, 1614
Date of Examination : 21.03.2025 FN
Exam Duration : 90 minutes Maximum Marks: 50

General instruction(s):

- Answer All Questions
- M - Max mark; CO – Course Outcome; BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)
- Course Outcomes(CO):
CO2: Apply rigorously formal mathematical methods to prove properties of languages, grammars and automata.
CO3: Identify limitations of some computational models and possible methods of proving them.
CO4: Represent the abstract concepts mathematically with notations.

Q. No	Question	M	CO	BL
1.	(a) Convert the following Grammar into Finite automata $S \rightarrow aA bB$ $A \rightarrow aA bS c$ $B \rightarrow bB a$ (3 Marks) (b) Let R_1 and R_2 be regular languages over Σ . Then, exclusive of R_1 and R_2 is defined as $EXC(R_1, R_2) = \{ x \in \Sigma^* : x \text{ in } \{R_1 - R_2\} \text{ or } x \text{ in } \{R_2 - R_1\} \}$. If x in $\{R_i - R_j\}$ means x is in R_i and not in R_j . Prove that $EXC(R_1, R_2)$ is regular. (3 Marks) (c) Using pumping lemma, demonstrate that the given language $L = \{x^i y^j z^k \mid k \leq i+j\}$ is not regular. (4 Marks)	10	CO 2	BL2
2.	Consider the following context free grammar (where S is the start symbol) $S \rightarrow AB BC$ $A \rightarrow BA a$ $B \rightarrow CC b$ $C \rightarrow AB c$ Apply CYK algorithm with all required steps for the input string "abbca".	10	CO 3	BL3
3.	a) Consider the following grammar (where U is the start symbol) remove all unit-productions, all useless productions, and all λ - productions from the grammar where $\Sigma = \{0,1\}$ $U \rightarrow 0V 0WW,$ $V \rightarrow 0V \lambda,$ $W \rightarrow 1W 11X,$ $X \rightarrow W.$	10	CO 3	BL3



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<p>After simplification convert the grammar into an equivalent grammar in Chomsky normal form (7 Marks)</p> <p>b) Show that the following grammar is ambiguous. What happens for the following string aaaab. Discuss in terms of parse tree. $S \rightarrow AB aaaB,$ $A \rightarrow a Aa,$ $B \rightarrow b.$ (3 Marks)</p>			
<p>4. a) Convert the following grammar to an equivalent grammar in GNF $S \rightarrow AB$ $A \rightarrow BB a$ $B \rightarrow AB a$ (6 Marks)</p> <p>b) Consider the context-free languages $L1 = \{a^{2n} b^k c^n \mid n, k \geq 1\}$. $L2 = \{a^m b^{2p} c^p \mid m, p \geq 1\}$. What is $L1 \cap L2$? Is it a context-free language? Justify briefly. (4 Marks)</p>	10	CO 3	BL3
<p>5. Construct a Non-deterministic push down automata (NPDA) that recognizes the language $L = \{ab(ab)^n x b(ab)^n a \mid n \geq 0, x = \{a, b\}\}$. Note that x is a symbol a or b. Describe the idea of your construction of transition rules and provide the transition rules. Show the configurations made by the constructed NPDA for the input string "ababababa".</p>	10	CO 4	BL3
