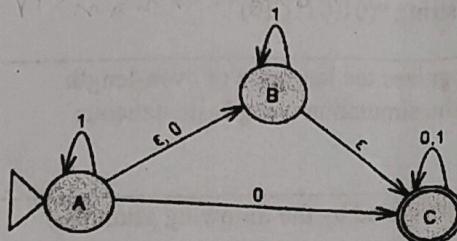


Maximum Marks: 100	Semester: January 2024 - April 2024	Duration: 3 Hrs.
Programme code: 01	Examination: ESE Examination	
Programme: BTech in Computer Engineering	Class: SY	Semester: IV(SVU 2020)
Name of the Constituent College: K. J. Somaiya College of Engineering	Name of the department: Computer Engineering	
Course Code: 116U01C404	Name of the Course: Theory of Automata with Compiler Design	
Instructions: 1) Draw neat diagrams 2) All questions are compulsory 3) Assume suitable data wherever necessary		

Que. No.	Question	Max. Marks
Q1	Solve any Four	20
i)	Construct a DFA that recognizes the language of all strings that contain '01' but do not contain '10'.	5
ii)	Give CNF for the given Grammar: $E \rightarrow E+T / T$ $T \rightarrow T^*F / F$ $F \rightarrow (E) / n$	5
iii)	Write Regular expression for the following : $L1 = \{ a^m b^n : m, n \text{ are even} \}$ $L2 = \{ a^m b^n : m >= 2, n >= 2 \}$	5
iv)	Explain how regular expressions are used in text processing tasks such as pattern matching, search, and substitution.	5
v)	Explain the concepts of decidability and undecidability in the context of Turing Machines.	5
vi)	Explain pumping lemma for CFG. Show that Language $\{a^m b^n c^k : k > n\}$ is not Context Free Language.	5

Que. No.	Question	Max. Marks
Q2 A	Solve the following	10
i)	Given regular expressions $R1 = (0+1)^*$ and $R2 = 1(01)^*$, perform the union operation to obtain a regular expression representing the language recognized by $R1 \cup R2$.	5
ii)	Convert the following NFA with ϵ into its equivalent NFA without ϵ .	5



Q2 A State Arden's Theorem. Find Regular Expression for the following Automata OR using Arden's Theorem.	10
Q2 B Solve any One i) Design Turing Machine to increment the value of any binary number by one. The output should also be a binary number with value one more than the number given. Show the simulation. ii) Design Turing Machine to accept the binary input having number of 0s twice than the number of 1s. Show the simulation of the machine.	10 10 10
Que. No. Question Max. Marks	
Q3 Solve any Two i) Simplify the given Grammar: $\begin{aligned} S &\rightarrow a / aA / B / C \\ A &\rightarrow aB / \epsilon \\ B &\rightarrow aA \\ C &\rightarrow aCD \\ D &\rightarrow dd \end{aligned}$	20 10
ii) Convert the following grammar into GNF: $\begin{aligned} S &\rightarrow X1Y \\ X &\rightarrow 0X1 / \epsilon \\ Y &\rightarrow 1Y0 / \epsilon \end{aligned}$	10
iii) Write CFG for the Language $(a^m b^k a^{2m}) \mid m, n, k > 0\}$. Give LMD, RMD and derivation Tree for the input string - "aaabbbaaaa" using the same Grammar.	10
Que. No. Question Max. Marks	
Q4 Solve any Two i) Design a pushdown automaton that recognizes the language of balanced parentheses, where '(' and ')' are properly matched. Show the simulation using Instantaneous description for the input string "(01(01)1)(0)". ii) Create a pushdown automaton that recognizes the language of even-length strings over the alphabet {0, 1}. Show the simulation using Instantaneous description for the input "00110100". iii) Construct PDA to accept the language generated by the following grammar: $\begin{aligned} S &\rightarrow A \mid B \\ A &\rightarrow aAb \mid ab \end{aligned}$	20 10 10 10

	$B \rightarrow abB \mid c$	
Que. No.	Question	
QS	(Write notes / Short question type) on any four	Max. Marks
i)	Explain different Variants of Turing Machines in brief.	20
ii)	Give Closure Properties of Context Free Languages with justification.	5
iii)	Explain Rice Theorem.	5
iv)	Design a Moore machine to determine the residue mod 5 for each binary string treated as integer.	5
xv	Explain Post Correspondence Problem. Show that the PCP with two lists $x = (b, bab, ba)$ and $y = (bb, ba, ab)$ has a solution. Give the solution sequence.	5
xvi	What is meant by ambiguous grammar? Test whether the given grammar is ambiguous or not. $S \rightarrow AB$ $A \rightarrow aAb \mid ab \mid \epsilon$ $B \rightarrow abB \mid c$	5