



**JSS MAHAVIDYAPEETHA**  
**JSS ACADEMY OF TECHNICAL EDUCATION, NOIDA**  
**DEPARTMENT OF INFORMATION TECHNOLOGY**

Roll No.

**CIA-I**

Course : B.Tech  
Semester : IV regular and lateral entry students  
Subject : Theory of Automata & Formal Languages  
Time : 9:30 – 11:00 AM

AY 2020-21 (Even Semester)  
Date : 11/05/2021  
Subject Code : KCS402  
Max. Marks : 30

**COURSE OUTCOMES**

- 211.1 Design deterministic and nondeterministic automata and regular expressions for specified regular languages
- 211.2 Convert among various notations for a regular language, such as DFAs, NFAs, and regular expressions.
- 211.3 Design grammar and PDA for CFL and state and prove their equivalence.
- 211.4 Design TM to recognize language and compute functions.
- 211.5 State and prove properties of regular, context free, recursive and recursive enumerable languages.
- 211.6 Explain the significance of the Universal Turing machine, Church-Turing thesis and concept of Undecidability.

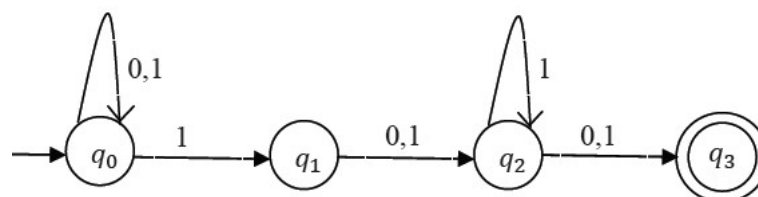
Q. No.	Questions	CO	BL
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**PART- A: Attempt All Questions (5x1 = 5Marks)**

- |    |   |     |   |
|----|---|-----|---|
| 1. | How many substrings aab are in $ww^Rw$ , where $w = aabbab$ ? | CO1 | 3 |
| 2. | Give the language of the following DFA                        | CO1 | 3 |

	a	b
$\rightarrow p^*$	q	r
q	r	p
r	r	r

- |    |   |     |   |
|----|---|-----|---|
| 3. | What is meant by equivalence of Moore and Mealy Machines?   | CO2 | 2 |
| 4. | Use extended transition function to show the result of giving string $w = 0011$ as input to the following finite automata | CO1 | 3 |

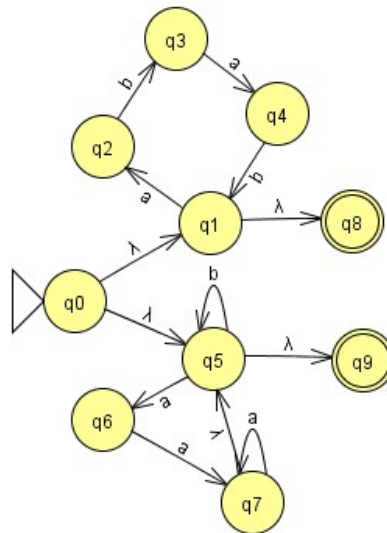


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|----|--|-----|---|
| 5. | Give the regular expression for the language $L = \{w \in \{0,1\}^*, \text{ such that } w \text{ ends with } 1 \text{ and does not contain the substring } 00\}$ | CO1 | 4 |
|----|--|-----|---|

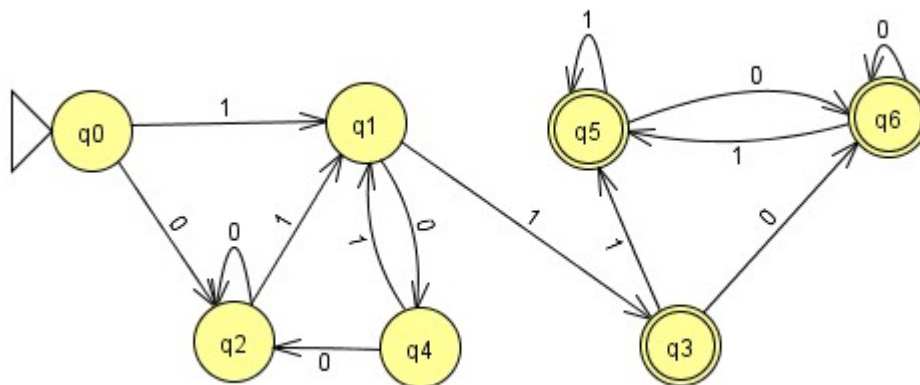
**PART-B: Attempt ANY THREE Questions (3x5 = 15Marks)**

- |    |   |     |   |
|----|---|-----|---|
| 6. | Construct a DFA to accept set of strings on $\{0,1\}$ in which, every substring of 3 symbols has at most two zeros. (All strings of length $\leq 2$ are also in the language) | CO1 | 4 |
|----|---|-----|---|

7. Give the epsilon closures of all the states in the following  $\epsilon$ NFA and construct DFA CO2 3  
equivalent to it.



8. Minimize the following DFA CO2 3



9. If R and S are two regular expressions, is  $(RS + R)^* R = R (SR + R)^*$ ? Justify your answer. CO2 4

**PART-C: Attempt ANY ONE Question (1x10 = 10Marks)**

10. a) Design a DFA for accepting binary numbers whose decimal equivalent is divisible by 5 CO1 4  
b) Convert the following NFA into a DFA CO2 3

	0	1
$\rightarrow q_0$	$q_0, q_1$	$q_0, q_3$
$q_1$	$q_2$	-
$q_2$ (Final)	-	-
$q_3$	-	$q_4$
$q_4$ (Final)	-	-

11. a) Design  $\epsilon$ -NFA for the language of strings consisting of either 01 repeated one or more times, or 010 repeated one or more times over alphabets  $\Sigma = \{0, 1\}$ . CO1 4  
b) Convert the following Mealy Machine into an equivalent Moore Machine CO2 3

	a	output	b	Output
A (Start)	C	1	D	0
B	A	0	B	1
C	B	1	C	1
D	C	0	A	1