



## Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058, India  
(Autonomous College Affiliated to University of Mumbai)

ESE  
22<sup>nd</sup> Nov 2019

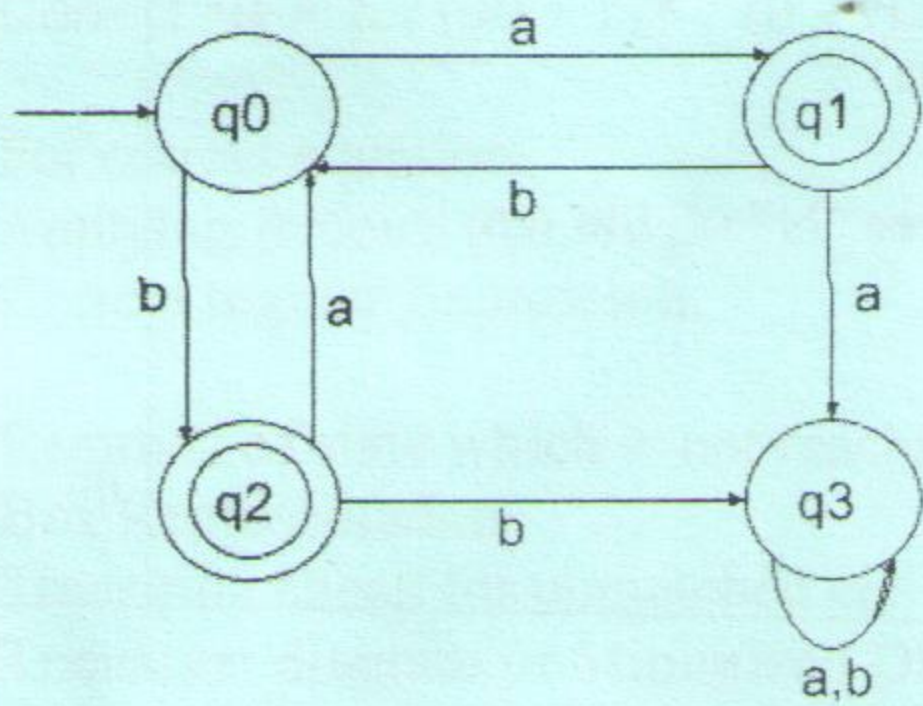
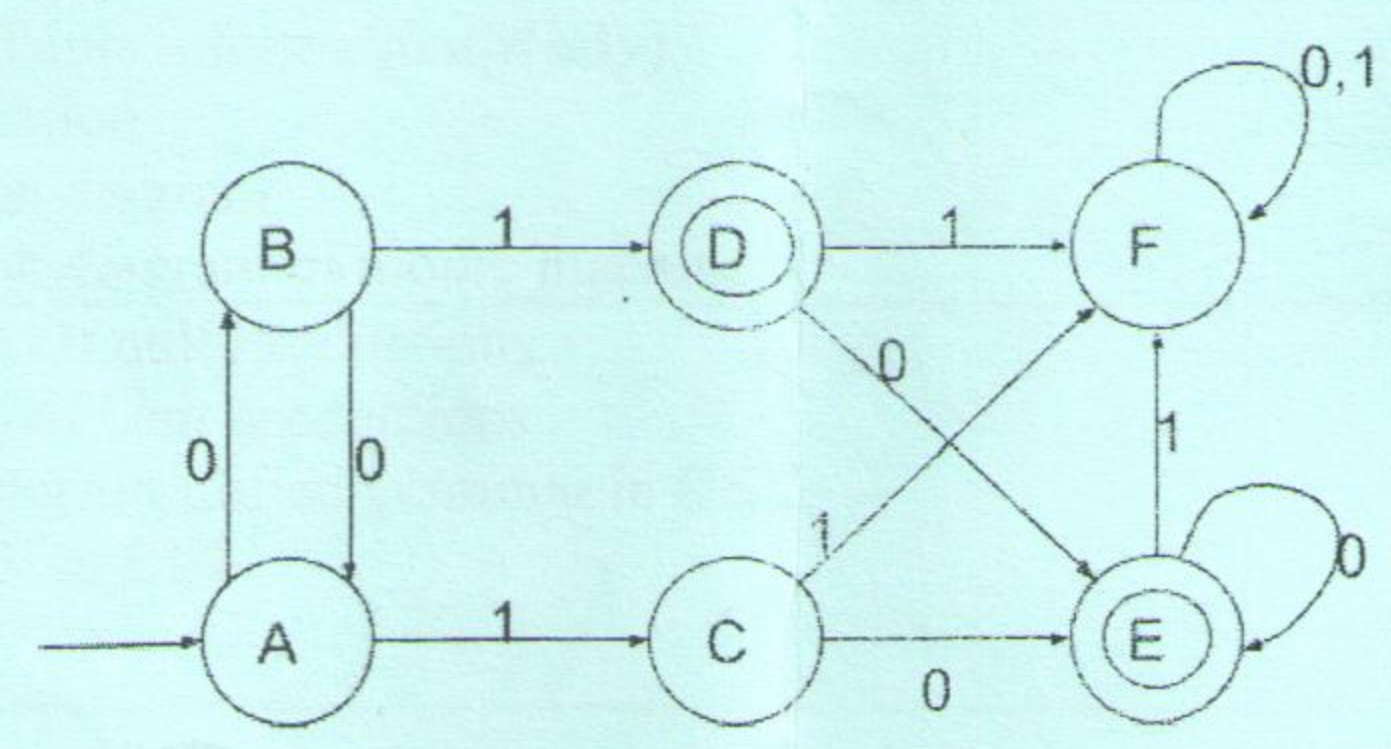
Max. Marks: 60  
Class: T.E. (V) Computer/IT  
Course Code: CE55/IT54

Duration: 180 min.  
Time: 10 AM -1 PM

Name of the Course: Theoretical Computer Science

### Instructions:

- (1) All questions are compulsory
- (2) Draw neat diagrams
- (3) Assume suitable data if necessary

Q. No.		Max Marks	CO-BL-PI
Q.1 a	Define Pumping Lemma for Regular Languages. Prove that the language $L = \{a^{n^2} : n \geq 0\}$ is not regular.	06	2-4-2.3.1
Q.1 b	Design FSM to add two binary numbers of same length	06	1-3-3.2.2
Q.2 a	Convert $(00 + 1)^* 1 (0 + 1)$ to a NFA-epsilon machine using regular expression to NFA guidelines	03	1-2-1.3.1
Q.2 b	Find the regular expression for the following using Arden's theorem 	03	1-3-1.3.1
Q.2 c	Minimize the following DFA using Myhill Nerode Theorem 	06	1-3-1.4.1



	OR		
	Design Mealy machine for $r=(0+1)^*(01+11)$ and converted it into Moore machine	06	1-3-3.2.2
Q.3 a	Given a CFG G, Find G' in CNF generating L(G)- $\epsilon$ $S \rightarrow ASB/\epsilon$ $A \rightarrow AaS/a$ $B \rightarrow SbS/A/bb$	06	3-3- 1.4.1
	OR Simplify the following grammar $S \rightarrow ASB/\epsilon$ $A \rightarrow aAS/a$ $B \rightarrow SbS/A/bb$	06	3-3- 1.4.1
Q.3 b	Find the GNF grammar equivalent to following CFG. $S \rightarrow BA/ab$ $B \rightarrow AB/a$ $A \rightarrow Bb/BB$	06	3-3-1.4.1
Q.4 a	With the help of diagram describe Chomsky hierarchy of formal languages.	06	3-2-1.4.1
Q.4 b	Define Recursively Enumerable languages and recursive languages with example.	06	3-2-1.4.1
Q.5 a	Define Post correspondence problem. Does PCP with following list have a solution? Justify your answer. $M = (abb, aa, aaa)$ and $N = (bba, aaa, aa)$	06	4-4-2.2.3
Q.5 b	Design Turing machine to copy given number "N" on the tape Where, input : $0^n$ Output: $0^n10^n$	06	4-3-3.2.2
	OR Convert the following CFG to PDA $S \rightarrow aSb/ab$	06	4-3-1.4.1