Shirpur Education Society's
R. C. PATEL INSTITUTE OF TECHNOLOGY, SHIRPUR
An Autonomous Institute
(Affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere)
आर. सी. पटेल इन्स्टिट्यूट ऑफ टेक्नॉलॉजी, शिरपूर
(स्वायत्त महाविद्यालय)

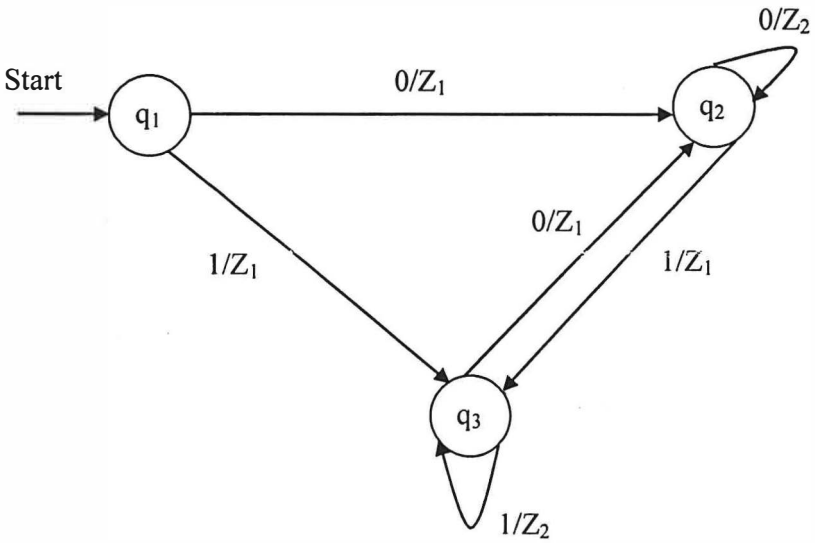
Academic Year (2021-22)
Year: 2 Semester: IV

Program: B. Tech. (Computer Engineering) **Max. Marks: 75**
Subject: Formal Language and Automata Theory (PCCO4020T) **Time: 10:30 am to 1:30 pm**
Date: *01/07/2022* **Duration: 3 Hours**

END SEMESTER EXAMINATION EVEN SEM (IV)

Instructions: Candidates should read carefully the instructions printed on the question paper and on the cover page of the Answer Book, which is provided for their use.

(1) This question paper contains 03 pages.
(2) All Questions are Compulsory.
(3) All questions carry equal marks.
(4) Answer to each new question is to be started on a fresh page.
(5) Figures in the brackets on the right indicate full marks.
(6) Assume suitable data wherever required, but justify it.
(7) Draw the neat labelled diagrams, wherever necessary.

Question No.		Max. Marks
Q1 (a)	Design FSM to check whether a given decimal number is divisible by three.	[05]
Q1 (b)	Construct the Moore machine equivalent to Mealy machine given by transition diagram below. 	[10]

OR

Construct a minimized DFA equivalent to DFA whose transition table is given below. [10]

State / ∑	a	b
→ q_0	q_1	q_2
q_1	q_4	q_3
q_2	q_4	q_3
(q_3)	q_5	q_6
(q_4)	q_7	q_6
q_5	q_3	q_6
q_6	q_6	q_6
q_7	q_4	q_6

Q2 (a) Convert the following grammar to CNF [08]

$S \longrightarrow ABC$
$A \longrightarrow a$
$A \longrightarrow b$
$B \longrightarrow Bb$
$B \longrightarrow aa$
$C \longrightarrow aC$
$C \longrightarrow cC$
$C \longrightarrow ba$

Q2 (b) Find the equivalent DFA accepting the regular language defined by the right linear grammar given as [07]

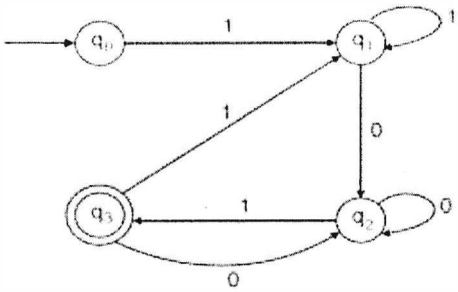
$S \longrightarrow 0A \mid 1B$
$A \longrightarrow 0C \mid 1A \mid 0$
$B \longrightarrow 1B \mid 1A \mid 1$
$C \longrightarrow 0 \mid 0A$

OR

Consider the grammar given as [07]
G = ({S, X}, {a,b},P, S)
Where P consists of,

$S \longrightarrow XX$
$X \longrightarrow XXX \mid bX \mid Xb \mid a$

For the string bbaaaab, find the leftmost derivation, rightmost derivation and derivation tree.

Q3 (a)	Construct a PDA accepting the language consisting of even palindromes strings of a's and b's. **OR** Construct a PDA that accepts the language generated by CFG $S \longrightarrow S + S \mid S * S \mid 4$	[07] [07]
Q3 (b)	Design a Turing Machine to check whether a given decimal number is divisible by three.	[08]
Q4 (a)	Show that the set $L = \{a^n b^{n+1} \mid n > 0\}$ is not regular. **OR** Find the regular expression corresponding to the automaton given in figure below 	[10] [10]
Q4 (b)	Prove that the regular expression $\Lambda + 1^*(011)^*(1^*(011)^*)^* = (1 + 011)^*$	[05]
Q5 (a)	**Solve any two.** i. Difference between DPDA and NPDA ii. Write a short note on: Halting problem of Turing Machine iii. Write a short note on: Types of Turing Machine	 [05] [05] [05]
Q5 (b)	Remove the $\in$ production from the given grammar G whose productions are $S \longrightarrow Xa$ $X \longrightarrow aX \mid bX \mid \in$	[05]

All the Best!