

B.Tech-5th(IT)
Formal Language and Automata Theory

Full Marks : 50

Time : $2\frac{1}{2}$ hours

Answer **all** questions

The figures in the right-hand margin indicate marks

Symbols carry usual meaning

1. Answer *all* questions : 2×5

(a) What is the significance of ϵ -Moves.

(b) List any 5 identity rules for regular sets.

(c) How do we say that the given grammar is ambiguous ? Explain with example.

(d) Explain the acceptance of PDA.

(e) Define turning machine. How a TM accepts a language ?

(Turn Over)

2. (a) Design a DFA for the following language

$$L = \{0^m 1^n \mid m \geq 0 \text{ and } n \geq 1\} \quad 4$$

(b) Define NFA with epsilon with an example. 4

Or

(a) Find DFA equal to NFA described by the following state transition table, initial state = p, f = {q, s} 4

States	0	1
$\rightarrow$ p	q, s	q
q	r	q, r
r	s	p
s	-	p

(b) Construct DFA and NFA accepting the set of all strings containing 101 as a substring. 4

3. (a) Consider the following regular expression and construct the finite automaton $a(a + b)^*b$. 4

(3)

(b) Convert the following Mealy machine into its equivalent Moore machine.

Present State	I/P=0		I/P=1	
	Next State	O/P	Next State	O/P
->A	C	0	B	0
B	A	1	D	0
C	B	1	A	1
D	D	1	C	0

Or

(a) Construct a Mealy machine which is equivalent to the Moore machine given in table.

4

Present State	Next State		Output
	a=0	a=1	
->p	p	q	0
q	p	r	0
r	p	r	1

(b) Prove $(a + b)^* = a^*(ba^*)^*$

4

4. (a) What is meant by ambiguous grammar ?
Test whether the grammar is ambiguous or not. 4

$S \rightarrow A \mid B$

$A \rightarrow aAb \mid ab$

$B \rightarrow abB \mid \epsilon$

- (b) Prove that the language $L = \{a^n b^n c^n \mid n \geq 1\}$ is not context free using pumping lemma. 4

Or

- (a) Obtain PDA to accept all strings generated by the language 4

$\{a^n b^m a^n \mid m, n \geq 1\}$

- (b) Convert the following grammar into CNF. 4

$S \rightarrow bA/aB$

$A \rightarrow bAA/aS/a$

$B \rightarrow aBB/bS/a$

5. (a) Discuss Chomsky's Hierarchy of formal languages. 4

(b) Construct a PDA which recognizes all strings that contain equal number of 0's and 1's. 4

Or

(a) Construct a PDA which recognizes all strings ww^R where $w \in \{a,b\}^*$. 4

(b) Prove that the following language is not context-free language $L = \{www | w \in \{a,b\}^*\}$ is not context free. 4

6. (a) What are the various variations of TM ? 4

(b) Explain P and NP problems. 4

Or

(a) Design Turing Machine to increment the value of any binary number by one. The

(6)

output should also be a binary number
with value one more the number given. 4

(b) Explain undecidability. Explain with
example. 4