

FORMAL LANGUAGES & AUTOMATA THEORY

(Computer Science & Engineering)

Time: 3 hours

Max. Marks: 70

PART – A

(Compulsory Question)

- 1 Answer the following: (10 X 02 = 20 Marks)
- What is induction principle? Give an example.
 - Draw finite automata that accept a string start with '1' and ends with '0', $\Sigma = \{0, 1\}$.
 - Construct a regular expression that accepts 3rd symbol from right end as 'a'.
 - Define Arden's theorem.
 - Construct the language L for $S \rightarrow aCa, C \rightarrow aCa/b$.
 - Give the general forms of CNF.
 - What is instantaneous description of PDA?
 - Draw push down automata that accept the language $L = \{a^n b^n / n \geq 1\}$.
 - Differentiate multi tape and multi track turing machine.
 - List the properties of recursively enumerable language.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

- 2 Determine minimal deterministic finite automata (DFA) for the given transition table over $\Sigma = \{0,1\}$, where A is the initial state and C is the final state

Symbol state	0	1
→ A	F	B
B	C	G
C *	C	A
D	G	C
E	F	H
F	G	C
G	E	G
H	C	G

OR

- 3 Construct DFA equivalent to NFA

$$\mu = (\{p,q,r\}, \{0,1\}, \delta, p, \{q,s\})$$

Where δ is defined in the following table:

δ	0	1
p	{q,s}	{q}
q*	{r}	{q,r}
r	{s}	{p}
S*	-	{p}

UNIT – II

- 4 Find whether the languages $\{ww/w \text{ is in } (1+0)^*\}$ and $\{1^k / k = n^2, n \geq 1\}$ are regular or not.

OR

- 5 Construct an NFA for the regular expression $(a+b)^*aab(a+b)^*$

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UNIT – III

- 6 For the given context free grammar (CFG) G, find Chomsky normal form (CNF). G has productions

$$S \rightarrow AaA / CA / BaB$$

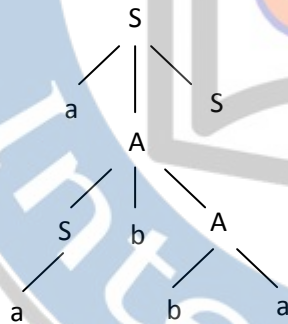
$$A \rightarrow aaBa / CDA / aa / DC$$

$$B \rightarrow bB / bAB / bb / aS$$

$$C \rightarrow Ca / bC / D$$

$$D \rightarrow bD / b$$
OR

- 7 (a) Explain the closure properties of Context Free languages.
 (b) Find the left most derivation and right most derivation to the following parse tree.

**UNIT – IV**

- 8 Convert the grammar $S \rightarrow oAA$, $A \rightarrow OS/1S/o$ to a PDA that accepts the same language by empty stack.

OR

- 9 Construct pushdown automata (PDA) for the following language:

$$L = \{a^{n+1} b^n : n \geq 0\}$$

Draw the transition diagram trace the string 'aaaabbb'.

UNIT – V

- 10 Design a Turing machine for the given language $L = \{0^n 1^{3n} : n \geq 1\}$. Write the transition table for the turning machine and show the tracing of string 00111111.

OR

- 11 Prove that L_d is not recursively enumerable.
