KADI SARVA VISHWAVIDHYALAYA

B.E. Semester V- Examination- April-2025

Subject Code:- IT503-N **Subject Name:- Formal Language & Automata Theory**

Date:- 11/ 04 /2025 **Time:-12:30 PM to 3:30 PM** **Total Marks:-70**

Instructions:

1. Answer each section in separate Answer sheet.
2. Use of scientific calculator is permitted.
3. All questions are Compulsory.
4. Indicate clearly, the options you attempt along with its respective question number.
5. Use the last page of main supplementary of rough work.

Section - I

Q-1. (A) Let A = {p,q,r,s}, Construct or find out Relations like Equivalence, Reflexivity, Symmetry, Transitivity with notation. [5]

(B) Construct DFA for the regular expression : [5]

1. (0+1)*
2. (a+b)*.ab

(C) Prove for every n>=1 by mathematical induction: [5]

$\sum_{i=1}^{n} i = n(n+1)/2$

OR

(C) Explain mathematical induction with any example. [5]

Q-2. (A) Covert Following Grammer in Chomsky Normal form. [5]

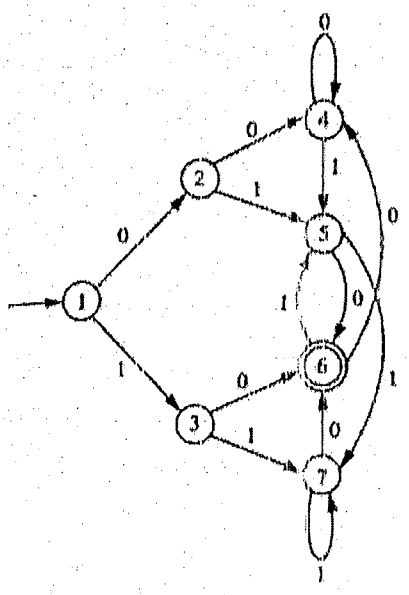
$S \rightarrow AACD$

$A \rightarrow aAb \mid \wedge$

$C \rightarrow aC \mid a$

$D \rightarrow aDa \mid bDb \mid \wedge$

(B) Minimize following Finite Automata [5]



OR

Q-2. (A) Define regular language and regular expressions. [5]

Describe the following by regular expression and construct DFA

a. L1 = the set of all strings of 0's and 1's ending in 00.

b. L2 = the set of all strings of 0's and 1's beginning with 0 and ending with 1.

(B) Find L1 U L2 and L1 ∩ L2. [5]

L1 = the set of all strings of 0's and 1's ending in 00.

L2 = the set of all strings of 0's and 1's beginning with 0 and ending with 1.

Q-3. (A) Define Non Deterministic Finite Automata? Compare its ability with Deterministic Finite Automata in accepting languages. [5]

(B) Convert the following NFA to it's equivalent DFA [5]

	0	1
p	{p,q}	{p}
q	{r}	{r}
r	{s}	ϕ
*s	{s}	{s}

OR

(A) Explain kleene's theorem part 1 with example of converting regular expression to equivalent NFA-null. [5]

(B) Convert following NFA (Nondeterministic finite automata) to DFA(Deterministic Finite automata) [5]

For $M = (Q, \Sigma, q_0, A, \delta)$ where $Q = \{q_0, q_1, q_2, q_3\}$, $\Sigma = \{0,1\}$, $A = \{q_3\}$ and δ is given by following table: Where q_0 is starting State. Where A is accepting states.

q	$\delta(q, 0)$	$\delta(q, 1)$
q_0	$\{q_0\}$	$\{q_0, q_1\}$
q_1	$\{q_2\}$	$\{q_2\}$
q_2	$\{q_3\}$	$\{q_3\}$
q_3	$\emptyset$	$\emptyset$

Section – II

Q-4. (A) Discuss about Universal Turing Machines. How does the Universal Turing machine simulate other Turing machines? [5]

(B) What is a recursive language and Recursive Enumerable Languages? Give an example. [5]

(C) Enlist and explain the operations performed by tape in Turing machine. [5]

OR

(C) What is the difference between NPDA and DPDA? [5]

Q-5. (A) Design a Push Down Automata for the language L= { $a^n b^n$ | n>0} [5]

(B) What is a derivation tree? Is the grammar {E→E+E| E-E| id } ambiguous? Why? [5]

OR

(A) Design Turing machine to accept language L={$a^n b^n$ | n >=1} [5]

(B) Design a CFG for the following language. [5]
L = { $a^i b^j c^k$ | i, j, k ≥ 0, and i = j or i = k }

Q-6. (A) Using Pumping lemma Show that the language L={ $a^n b^n c^n$ | n>=1} is not a Context Free Grammar [5]

(B) Design Turing machine to compute palindrome over {a,b}. [5]

OR

(A) Design a PDA to accept L = {xcy | x, y∈ (a,b)* and |x| = |y|}. [5]

(B) Definition of Context Sensitive languages and explain Linear Bounded Automata. [5]

-------- All the Best----------