5th 10

Exam. Code: 0917
Sub. Code: 6790

1128

B.E. (Computer Science and Engineering)
Fifth Semester
CS-505: Theory of Computation

Time allowed: 3 Hours **Max. Marks: 50**

NOTE: Attempt five questions in all, including Question No. I which is compulsory and selecting two questions from each Section.

x-x-x

I. Write short answers of the following:
a. Prove or disapprove: $(R+S)^*S = (R^*S)^*$
b. Is the grammar $S \rightarrow SS|S|S(S)S|\epsilon$ ambiguous? Why or why not?
c. What is difference between Kleene closure and Kleene positive closure? Give example.
d. What are regular expressions? List their applications.
e. What is polynomial time reduction? (2× 5=10)

Section-A

II.
a. Design a finite automaton M over {0,1} to accept all strings satisfying the following conditions:
   i. Ending with 111 or 000
   ii. Starting with 111 or 000
   iii. Containing the substring 111 or 000
b. State pumping lemma for regular sets. Using pumping lemma, show that the set $\{w|w \text{ is a palindrome over } \{0,1\}\}$ is not regular. (6,4)

III.
a. Construct a minimum state automaton equivalent to DFA whose transition table is given below:

State	0	1
$\rightarrow q_1$	q_2	q_3
q_2	q_3	q_5
q_3 Final state	q_4	q_3
q_4	q_3	q_5
q_5 Final state	q_2	q_5

b. Given a CFG $G(\{S,A,B\},\{0\},P,S)$ with its production set as $S \rightarrow AAA|B,\ A \rightarrow 0A|B,\ B \rightarrow \epsilon$. Remove null productions from this grammar and create a new grammar G_1 such that $L(G_1) = L(G) - \epsilon$. (6,4)

IV.
a. Prove that $(a^*ab + ba)^*a^* = (a + ab + ba)^*$.
b. Convert the CFG $S \rightarrow XY1|0,\ X \rightarrow 00X|1,\ Y \rightarrow 1X1$ into Greibach Normal Form. (4,6)

P.T.O.

Section-B

V.

a. State the pumping lemma for Context-free languages. Using pumping lemma, show that the language $\{0^m 1^n | m \neq n\}$ is not context-free.

b. Convert the grammar $S \rightarrow S0S1S0S|S0S0S1S|S1S0S0S|\epsilon$ to a PDA that accepts the same language by empty stack.

(5,5)

VI.

a. Describe Turing machine model. Describe multi-tape Turing machine as an extension to the basic Turing machine. Does the multi-tape Turing machine and basic Turing-machine have same language-recognizing power? Comment.

b. Design a Turing machine over $\Sigma = \{0,1\}$ to accept the language $L = \{0^m 1^{2m} | m > 0\}$.

(5,5)

VII. Write short notes on:

a. Recursive and recursively enumerable languages

b. P and NP completeness

(5,5)

x-x-x