U.S.N

P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)
Fourth Semester, B.E. - Computer Science and Engineering
Semester End Examination; July/August - 2022
Theory of Computation

Time: 3 hrs   *Max. Marks: 100*

<u>*Note*</u>: I) *PART - A* is compulsory. *Two* marks for each question.
   II) *PART - B*: Answer any <u>*Two*</u> sub questions (from a, b, c) for a Maximum of *18 marks* from each unit.

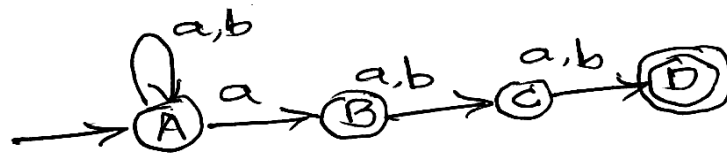| Q. No.	Questions	Marks
	I : PART - A	**10**
I a.	Define DFA.	2
b.	Define Regular Expression.	2
c.	Write CFG for the CFL L= $\{a^n b^{2n} \mid \geq 0\}$.	2
d.	Define DPDA.	2
e.	Define TM.	2
	II : PART - B	**90**
	UNIT - I	**18**
1 a.	Design a DFA to recognise all the strings, over $\sum = \{a, b\}$, which ends with '*aba*'.	9
b.	Convert the following NFA into its equivalent DFA and hence state the language recognised by the same.	9

Fig Q1(b)

c.   Convert the following €-NFA into its equivalent DFA and hence state the language recognised by the same.   9

Fig Q1(c)

UNIT - II   **18**

2 a.   Write regular expression for the following regular languages over $\sum = \{a, b\}$ 9

   i) Ends with either *abb* or *aba* or *aab*

   ii) L = $\{a^i b^j \mid (i+j) \text{ is even}\}$

   iii) $\mid W \mid \bmod 3 = 2$

b. State and prove pumping lammra for regular languages. 9

c. Prove that for every regular expression ,R, representing the regular language L(R), there is an equivalent DFA,M such that L(M) = L(R). 9

UNIT - III **18**

3 a. Write CFG for the following CFLs:

i) $L=\{a^i\, b^j\, c^k \mid i =j \text{ or } j=k \text{ or } k=i\}$

ii) $L=\{a^i\, b^j\, c^k \mid i=3(j +k)\}$

iii) Palindrome over $\sum=\{a ,b\}$ 9

b. Define ambiguous grammar and hence prove that the following grammar is ambiguous $E{\rightarrow}E+E \mid E*E \mid id$ 9

c. Convert the given CFG into its equivalent PDA $E{\rightarrow}E+E \mid E*E \mid id$ 9

UNIT - IV **18**

4 a. Design PDA for the following CFL $L=\{a^i b^j c^k \mid i=j+k\}$ 9

b. Design PDA to recognise the CFL, $L=\{W \in\{a,b\}* \mid n_a(W)= n_b(W)\}$. State whether the resultant PDA is DPDA/NPDA. Justify your answer. 9

c. Define PDA, Instantaneous description a PDA and language accepted by PDA. 9

UNIT - V **18**

5 a. Design TM to recognize the language $L = \{a^n b^n c^n \mid n \geq 0\}$ 9

b. Explain any two extensions of TM. 9

c. Explain recursively enumerable languages and post's correspondence problem. 9

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