Roll No……

Dr B R Ambedkar National Institute of Technology, Jalandhar

B Tech (Computer Science & Engineering)

CSX – 302, Theory of Computation

End Semester Examination, July 2020

Duration: 90 Minutes Max. Marks: 30 Date: 20 July 2020

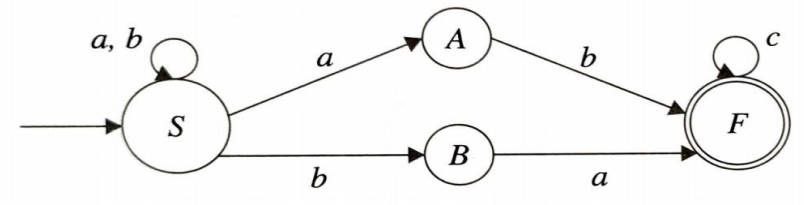
Marks Distribution & Mapping of Questions with Course Outcomes (COs)								
Question Number	1	2	3	4	5			
Marks	6	6	6	6	6			
CO No.	3	2, 4	4	2, 4	4			
Learning Level	1	2	2	3	3			

Note:

1. Attempt all the questions.
2. Write the answers in hard copy (on A4 or any other sheet available) using blue/black pen with their sign on top and bottom of each page. Also put page numbers on upper right corner of each page of the answer booklet.
3. The time allowed for writing examination is 90 minutes. Extra 20 minutes are allowed for scanning and sending the answer booklet.
4. Follow the instructions regarding submission of answer booklet as issued by examination section.

1. (a) Construct a finite automata for the regular language represented by the given regular expression $(a + b)^* cd^* e)$.

   (b) Find the regular expression corresponding to the finite automata as given follows:



2. Obtain the Context Free Grammar (CFG) for the following Languages.

   (a) $L_1 = \{s \mid n_a(s) = n_b(s)\}$

   (b) $L_2 = \{s \mid n_a(s) \neq n_b(s)\}$

(c) $L_3 = \{s \mid |s| \; mod \; 3 = 0 \text{ and } \Sigma = \{a\}\}$

3. The production system of a Context Free Grammar (CFG) $G = (V_N = \{S, A, B\}, \Sigma = \{a, b\}, P, S)$ is S → A, A→aBa | a, B→bAb | b. Create an equivalent CFG G_1 in Greibach Normal Form (GNF).

4. (a) Design a Push Down Automata (PDA) which accepts the $2 \times p$ number of 2's followed by p number of 3's over the input symbols 2 and 3, where p is the natural numbers.

   (b) Convert the given Push Down Automata (PDA) $M = (\{P_0, P_1, P_2\}, \{2,3\}, \{Z_0, 2\}, \delta, \{P_0\}, \{Z_0\}, \varphi)$ in the corresponding Context Free Grammar (CFG):

   $\delta(P_0, 2, Z_0) \rightarrow (P_0, 2Z_0)$ $\quad$ $\delta(P_1, 2, 2) \rightarrow (P_2, \epsilon)$
   $\delta(P_0, 2, 2) \rightarrow (P_0, 22)$ $\quad$ $\delta(P_2, 2, 2) \rightarrow (P_2, \epsilon)$
   $\delta(P_0, 3, 2) \rightarrow (P_1, 2)$ $\quad$ $\delta(P_2, \epsilon, Z_0) \rightarrow (P_2, \epsilon)$

5. Construct the Turing Machine which determines the following language $L_4 = \{\lambda \mid \lambda \; \epsilon \; (2 + 3)^+ \; and \; \; n_2(\lambda) = n_3(\lambda) \}$.