

**II B. Tech II Semester Regular Examinations, April - 2018**  
**FORMAL LANGUAGES AND AUTOMATA THEORY**

(Computer Science and Engineering)

Time: 3 hours

Max. Marks: 70

- Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)  
 2. Answer **ALL** the question in **Part-A**  
 3. Answer any **FOUR** Questions from **Part-B**
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**PART -A**

1. a) Define NFA? (2M)
- b) What is pumping Lemma? (2M)
- c) For the Grammar  $\{S \rightarrow AS/a, A \rightarrow SbA/SS/ba\}$  construct Left most derivation for the string aabbbaaa? (3M)
- d) Define Context Free Language? (2M)
- e) When do you say that a Turing Machine accepts a string? (2M)
- f) Give an example of undecidable problem? (3M)

**PART -B**

2. a) Construct Minimum state Automata for the following DFA? (7M)  
 \* denotes final state

$\delta$	0	1
$\rightarrow q1$	q2	q6
q2	q1	q3
*q3	q2	q4
q4	q4	q2
q5	q4	q5
*q6	q5	q4

- b) Differentiate between NFA and DFA? (7M)
3. a) Construct a DFA for the Regular Language consisting of any number of a's and b's (7M)
- b) Explain about the identity rules of Regular Expressions? (7M)
4. a) Define Ambiguous Grammar? Check whether the grammar  $S \rightarrow aAB, A \rightarrow bC/cd, C \rightarrow cd, B \rightarrow c/d$  Is Ambiguous or not? (7M)
- b) Obtain GNF  $S \rightarrow AB, A \rightarrow BS/b, B \rightarrow SA/a$  ? (7M)

5. a) Show that for every PDA then there exists a CFG such that  $L(G)=N(P)$ ? (7M)  
b) Construct a Turing Machine that will accept the Language consists of all palindromes of 0's and 1's? (7M)
6. a) Construct a Turing Machine to recognize the Language  $\{ a^n b^n c^n / n \geq 1 \}$  (7M)  
b) Discuss in brief about Turing reducibility? (7M)
7. a) Explain in detail about NP Complete and NP hard problems? (7M)  
b) Define Post Correspondence Problem? Explain in brief about PCP with an example? (7M)

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**PART -A**

1. a) Draw a NFA which accepts the set of all strings whose second last symbol is 1? (3M)
- b) Construct a Finite Automata that accepts  $\{0,1\}^+$  (2M)
- c) Construct a Derivation tree for the string 0011000 using the grammar  $S \rightarrow A0S/0/SS, A \rightarrow S1A/10$  ? (3M)
- d) Define Push Down Automata? (2M)
- e) Give an Example of a Recursive enumerable language? (2M)
- f) What is undecidable problem? How it can be solved? (2M)

**PART -B**

2. a) Design DFA for the following over  $\{a,b\}$ . (7M)
  - i) All string containing not more than three a's. ?
  - ii) All strings that has at least two occurrences of b between any two occurrences of a.?
- b) Construct a DFA accepting the set of all strings ending with 00? (7M)
3. a) Define Regular Expression? Explain about the Properties of Regular Expressions? (7M)
- b) Construct a DFA for the Regular expression  $(0+1)^* (00+11) (0+1)^*$  ? (7M)
4. a) Define Grammar? Explain about Chomsky Classification of Grammars? (7M)
- b) Obtain GNF equivalent to the grammar  $E \rightarrow E+T/T, T \rightarrow T*F/F, F \rightarrow (E)/a$  ? (7M)
5. a) Convert the grammar  $S \rightarrow 0AA, A \rightarrow 0S/1S/0$  to a PDA that Accepts the same Language by Empty Stack? (7M)
- b) Construct a PDA for the following grammar  $S \rightarrow AA/a, A \rightarrow SA/b$  ? (7M)
6. a) Design a Turing Machine for  $L = \{0^n 1^m 0^n / m, n \geq 1\}$  (7M)
- b) Explain about types of Turing Machine? (7M)
7. a) Explain about the Decidability and Undecidability Problems? (7M)
- b) Discuss in brief about NP Hard problems? (7M)

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**PART -A**

1. a) Write about the applications of Finite Automata? (2M)
- b) If a Regular grammar G is given by  $S \rightarrow aS/a$  Find DFA (M) accepting  $L(G)$ ? (2M)
- c) Construct a Left most Derivation for the string 0011000 using the grammar  $S \rightarrow A0S/0SS, A \rightarrow S1A/10$  ? (3M)
- d)  $\{a^n b^n c^n / n \geq 1\}$  is not recognised by PDA. why? (3M)
- e) What are the components of a Turing Machine? (2M)
- f) Define Post correspondence Problem? (2M)

**PART -B**

2. a) Define Finite Automaton? Explain about the model of Finite Automaton? (7M)
- b) Design a NFA for the following language  $L = \{0101^n \text{ where } n > 0\}$  (7M)
3. a) Construct Finite Automata for the regular Expression  $1(01+10)^*00$ ? (7M)
- b) Show that  $L = \{a^{2^n} / n < 0\}$  is Regular? (7M)
4. a) Obtain the Chomsky normal form for the following grammar  $E \rightarrow E+T/T, T \rightarrow a/CE$ ? (7M)
- b) Construct a derivation tree for the string abcd from the grammar  $S \rightarrow aAB, A \rightarrow bC, B \rightarrow d, C \rightarrow cd$  (7M)
5. a) Construct a PDA for  $L = \{wcw^R / w \in (0+1)^*\}$  (7M)
- b) Construct a PDA for the following grammar (7M)
6. a) Design a Turing Machine to recognize the language  $\{0^n 1^n 0^n / n \geq 1\}$  (7M)
- b) Discuss in brief about church hypothesis? (7M)
7. a) What is decidability? Explain in brief about any two undecidable problems? (7M)
- b) Explain about Universal Turing Machine? (7M)

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**PART -A**

1. a) Define DFA? (2M)
- b) Construct a regular grammar for  $L = \{0^n 11/n \geq 1\}$  (3M)
- c) Write a Context free grammar for the language  $\{0^n 1^n/n \geq 1\}$  (3M)
- d) What is an instantaneous description in PDA? (2M)
- e) What is the purpose of studying Turing Machine? (2M)
- f) Define Unrestricted grammar? (2M)

**PART -B**

2. a) Construct Minimum state Automata for the following DFA ? (7M)

\* denotes final state

$\delta$	0	1
$\rightarrow q_1$	$q_2$	$q_3$
$q_2$	$q_3$	$q_5$
$*q_3$	$q_4$	$q_3$
$q_4$	$q_3$	$q_5$
$*q_5$	$q_2$	$q_5$

- b) Explain in detail about Melay and Moore Machines? (7M)
3. a) Explain about the Closure Properties of Regular sets? (7M)
- b) Construct a NFA equivalent to the regular expression  $10(0+11)0^*1$ ? (7M)
4. a) Show that  $L = \{a^p / p \text{ is prime}\}$  is Context free? (7M)
- b) Construct CNF for the Grammar  $S \rightarrow ABC, A \rightarrow 0B, B \rightarrow CD/0, C \rightarrow 1$  (7M)
5. a) Construct a PDA for  $L = \{a^n b^n c^n / n > 0\}$  (7M)
- b) Construct a PDA M equivalent to the following CFG  $S \rightarrow 0BB, B \rightarrow 0S/1S/0$ , test whether  $010^4$  is in  $N(M)$ ? (7M)

6. a) Construct Turing machine for the languages containing the set of all strings of balanced paranthesis? (7M)  
b) Define Turing Machine? Explain about the Model of Turing Machine? (7M)
7. a) Explain in detail about Halting Problem of Turing machine? (7M)  
b) Define LR(0) Grammar? Explain in detail about PCP? (7M)

