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A – 4201

Reg. No. :

Name :

Fourth Semester B.Tech. Degree Examination, June 2016
13.406 : FORMAL LANGUAGES AND AUTOMATA THEORY (R)
(2013 Scheme)

Time : 3 Hours

Max. Marks : 100

PART – A

Answer **all** questions. **Each** question carries **4** marks.

1. Design a NFA for the set of all strings that begin with 01 and ends with 11 if $\Sigma = \{0, 1\}$.
2. Show that the regular languages are closed under concatenation.
3. Explain the applications of Finite Automata.
4. What can you infer about the grammar $E \rightarrow E - E \mid E/E \mid id$ and the input $a/b-c$.
5. Prove that the diagonal language L_d is not recursively enumerable where
 $L_d = \{w_i \mid w_i \text{ is string over } 0 \text{ and } 1 \text{ and is not accepted by turing machine } T_i\}$



PART – B

Answer **one full** question from **each** Module. **Each full** question carries **20** marks.

Module – I

6. Prove that a language L is accepted by some DFA if and only if L is accepted by some ϵ -NFA. Illustrate the same with an example. 20

OR

7. Design a DFA accepting the set of all strings containing 101 as a substring over the alphabet $\{0, 1\}$. 20

Module – II

8. Compute the Regular Expression for the DFA $M = (\{a, b, c, d\}, \{0, 1\}, \delta, a, \{c, d\})$ and $\delta(a, 0) = b, \delta(a, 1) = a, \delta(b, 0) = b, \delta(b, 1) = c, \delta(c, 0) = d, \delta(c, 1) = b, \delta(d, 0) = d, \delta(d, 1) = a$. 20

OR

P.T.O.



9. A) Convert the Regular expression $011(01+1)^*$ to ϵ -NFA. 4
 B) Prove that the Language $\{a^n b^m c^m d^n \mid n, m \geq 1\}$ is not regular. 8
 C) Prove that if L and M are regular languages, then so is $L \cap M$. 8

Module - III

10. a) Convert the grammar to Chomsky Normal form

$$S \rightarrow ABC \mid BaB$$

$$A \rightarrow aA \mid BaC \mid aaa$$

$$B \rightarrow bBb \mid a \mid D$$

$$C \rightarrow CA \mid AC$$

$$D \rightarrow \epsilon$$

10

- b) Design CFG for the following context free languages.

i) $L_1 = \{u \in \{a,b\}^* \mid u \text{ is not a palindrome}\}$

ii) $L_2 = \{u \in \{a,b\}^* \mid u \text{ is not of the form } ww \text{ for some string } w \in \{a,b\}^*\}$.

10

OR

11. a) Design a PDA to accept well-formed strings over $\Sigma = \{(,)\}$. 12

- b) Explain why the following CFG is ambiguous

$$G = (\{A, B, S\}, \{0, 1\}, \{S \rightarrow 0A \mid 1B, A \rightarrow 0AA \mid 1S \mid 1B \rightarrow 1BB \mid 0S \mid 0\}, S)$$

8

Module - IV

12. Design a Turing machine to accept the set of all strings over $\Sigma = \{a, b\}$ beginning with 'a' and ending with 'b'. Illustrate the operation of the Turing machine for the input 'a a a b b'. 20

OR

13. a) Is 'Post Correspondence Problem' decidable? Explain. 12

- b) Show that recursive languages are closed under UNION. 8

(4x20=80 Marks)