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**Question Paper Code : 23384**

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2018.

Fifth Semester

Computer Science and Engineering

CS 2303 — THEORY OF COMPUTATION

(Common to Seventh Semester Information Technology)

(Regulations 2008)

(Also common to PTCS 2303 — Theory of Computation for B.E. (Part – Time) Fifth Semester — CSE — Regulations 2009)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Any set  $A$ ,  $B$ , and  $C$  if  $A \cap B = \phi$  and  $C \subset B$  then  $A \cap C = \phi$ . Prove by contrapositive.
2. Prove for every  $n \geq 1$  by mathematical induction  
$$\sum_{i=1}^n i^2 = n(n+1)(n+2)/6.$$
3. State pumping lemma for regular languages.
4. Construct NFA equivalent to the regular expression:  $(0+1)01$ .
5. Specify the use of context free grammar.
6. Define parse tree with an example.
7. State the pumping lemma for CFLs.
8. What are the applications of Turing Machine?
9. What is meant by recursive enumerable language?
10. Define PCP.

PART B — (5 x 16 = 80 marks)

11. (a) (i) Explain the different forms of proof with examples. (8)  
(ii) Prove that, if  $L$  is accepted by an NFA with  $\varepsilon$ -transitions, then  $L$  is accepted by an NFA without  $\varepsilon$  transitions (8)

Or

- (b) (i) Prove that if  $n$  is a positive integer such that  $n \bmod 4$  is 2 or 3 then  $n$  is not a perfect square. (6)  
(ii) Construct a DFA that accept the following language. (10)  
 $\{x \in \{a, b\} : |x|_a = \text{odd and } |x|_b = \text{even.}$

12. (a) Find the min-state DFA for  $(0+1)^*10$ .

Or

- (b) Find the regular expression of a language that consist of set of string starts with 11 as well as ends with 00 using Rij formula.

13. (a) Discuss the following

- (i) CFG and Parse trees (6)  
(ii) Ambiguity in Context Free Grammars with example. (10)

Or

- (b) (i) Construct PDA for the language  
 $L = \{ww^R \mid w \text{ is in } \{0, 1\}^*\}$ . (10)  
(ii) Discuss on Deterministic PDA. (6)

14. (a) (i) Explain Turing machine as a computer of integer functions with an example. (10)  
(ii) Remove  $\epsilon$  productions from the given grammar. (6)

Or

- (b) Write short notes on the following  
(i) Two-way infinite tape TM. (8)  
(ii) Multiple tracks TM. (8)

15. (a) (i) Explain undecidability with respect to post correspondence problem. (8)  
(ii) Discuss the properties of recursive languages (8)

Or

- (b) (i) Explain any two undecidable problems with respect to Turing machine. (8)  
(ii) Discuss the difference between NP-complete and NP-hard problems. (8)