G 1872 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2012

Fourth Semester

Branch : Computer Science and Engineering / Information Technology

CS 010 406 / IT 010 404—THEORY OF COMPUTATION (CS, IT)

(Regular—2010 Admissions)

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 3 *marks.*

1. Explain the principle of Mathematical Induction.
2. Differentiate between Deterministic and Non-deterministic Finite automata.
3. Define instantaneous description of push down automata.
4. Design a TM that accepts the language of odd integers written in binary.
5. What is meant by halting problem ?

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each question carries 5 *marks.*

6. Prove that all natural numbers of the form $n^3 + 3n$ are divisible by 3 using principle of induction.
7. Construct an NFA equivalent to the regular expression (0 + 1) (00 + 11) (0 + 1).
8. State and prove the pumping lemma.
9. Describe the Turing Machine which shifts a string w containing no blanks to one cell to the left.
10. Explain briefly NP hard and NP complete problems.

(5 × 5 = 25 marks)

Part C

Answer **either** (*a*) **or** (*b*) from *each question.*
Each full question carries 12 *marks.*

11. (a) With an example explain Primitive and partial recursive functions.

Or

(b) Define Diagonalization principle. Prove that the set is uncountable.

Turn over

12. (a) Prove that if a language C is accepted by some NFA, iff it is accepted by some DFA.

Or

(b) Show that the language $\{a^n e^n = i^L, i \geq 1\}$ is not regular.

13. (a) Obtain a CFG to generate a language of all non-palindrome over the alphabet $\Sigma = \{a, b\}$. Trace for a string of acceptable and non-acceptance using Left most derivation.

Or

(b) Show that any CFL without ε can be generated by an equivalent grammar in Chomsky Normal Form.

14. (a) Is the language $\alpha(G) = \{abc / n \geq 0\}$ accepted by the Turing machine ? If so, construct the Turing machine for the same and trace for a two strings, one for acceptance and other for rejection.

Or

(b) (i) Explain briefly the church Turing Thesis. (4 marks)

(ii) Explain :

1 A random access TM. (4 marks)

2 Non-deterministic TM. (4 marks)

15. (a) Write the characteristic features of p-completeness. Explain briefly with an example.

Or

(b) (i) Distinguish P, NP, NP-Hard and NP-complete problems. (6 marks)

(ii) Explain any *two* applications of NP-complete problems. (6 marks)

[5 × 12 = 60 marks]