FIRST SEMESTER M.Sc. DEGREE EXAMINATION, JANUARY 2014

(CUCSS)

Computer Science

CSC IC 03—THEORETICAL COMPUTER SCIENCE

Time : Three Hours   Maximum : 36 Weightage

Part A

*Answer **all** questions.*
Each question carries 1 weightage.

1. Define regular language.

2. Define non-deterministic automata.

3. Give one example each for right linear and left linear grammar.

4. Define PDA.

5. Define Chomsky Normal Form.

6. Find the context free grammar for

   $$L = \{a^n b^m : n \quad m+3, n \quad 0, m \quad 0\}.$$

7. Define universal Turing Machine.

8. Define Type 0 grammar.

9. Define recursive language.

10. State Cook's theorem.

11. State Compactness theorem.

12. Explain normal forms in predicate calculus.

(12 x 1 = 12 weightage)

Part B

*Answer any **six** questions.*
Each question carries 2 weightage.

13. Give DFAs for the language on $E = \{a, b\}$

    $$L = \{a^n b^m : n \quad 2, m \quad 3\}.$$

    $$L = \{w : |w| \bmod 3 = 0\}.$$

Turn over

14. Discuss the equivalence of DFA and NFA.

15. Define derivation tree. Give example.

16. Convert the following grammar into CNF :

$$S \rightarrow ab\text{AB}$$
$$A \rightarrow b\text{AB I A,}$$
$$B \quad Baa\,|\text{A}|\text{X.}$$

17. Explain the equivalence of Type 0 grammar with Turing Machine.

18. Establish the equivalence of standard Turing Machine with Multi-tape and Nondeterministic Turing Machines.

19. Discuss Travelling Sales Person's problem in the context of computational complexity.

20. Write notes on P and NP classes.

21. Explain resolution with suitable examples.

(6 x 2 = 12 weightage)

Part C

Answer any **three** *questions.*
Each question carries 4 weightage.

22. Discuss Kleen's theorem.

23. Discuss the equivalence of CFG and PDA.

24. With examples explain Turing acceptable and Turing decidable language classes.

25. Write notes on :

    (a)   Undecidability.

    (b)   NP completeness.

    (c)   Post correspondence problem.

26. State and explain Lowen-Skolem theorem.

27. State and prove pumping lemma for the existence of Non-context free languages.

(3 x 4 = 12 weightage)