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**CS-73**

17462

# BACHELOR IN COMPUTER APPLICATIONS

## Term-End Examination

## June, 2010

## CS-73 : THEORY OF COMPUTER SCIENCE

*Time : 3 hours* *Maximum Marks : 75*

***Note :*** *Question **No. 1** is **compulsory.** Attempt **any three** questions from the rest.*

**1.** (a) Explain ***any five*** of the following concept, each with one suitable example : **20**

(i) Regular language

(ii) Finite automata

(iii) Context - free grammar

(iv) Pushdown automata

(v) Universal Turing Machine

(vi) NP - hard problem

(vii) Undecidable problem

(b) (i) Construct an NFA accepting the language **10**

$L = \{ 001, 100 \}$

(ii) Show that the language

$$L = \left\{a^{n^2} | n \geq 1\right\}$$

is not context free.

2. (a) For the following regular expression, construct equivalent finite automata : 7

b*a + a*b.

(b) Show that the following language L is not regular : 8

$L = \{a^p : p \text{ is a prime}\}$.

3. (a) Tell which of the following types of languages are closed under : 6

(i) Complementation

(ii) Intersection

(iii) Union :

(A) Regular languages

(B) Context - free languages

(C) Unrestricted languages

(b) Show that the language : 9

$L = \{a^n b^n c^n | n \geq 1\}$

is not a context - free language.

4. (a) Give recursive definition of $\sum_{i=1}^{n} i$, the sum of first $n$ natural numbers. 3

(b) Explain what is a partial function and further, why we need a partial function ? 7

(c) Tell whether the square - root function 5

$$SQRT : N \rightarrow N,$$

where N denotes the set of natural numbers, is a partial function or not. Further, justify your answer.

5. (a) For the function defined as : 5

$$f(x) = 4x^5 + 7x + 11,$$

show that $f(x) = 0\ (x^5)$,

where O denotes big oh

(b) Mention any five undecidable problems discussing each briefly. 5

(c) Name five NP-complete problems. 5