Printed Pages: 3 **MCAE-15**

(Following Paper ID and Roll No. to be filled in your Answer Books)	
Paper ID : 214460	**Roll No.**

M.C.A.

Theory Examination (Semester-IV) 2015-16

THEORY OF AUTOMATA AND FORMAL LANGUAGES

Time : 3 Hours ***Max. Marks : 100***

Note:- Attempt all questions.

1. Attempt any four of the following. (5×4 = 20)

(a) State and prove Pumping Lemma for Regular Set.

(b) What is the difference between Recursive and Recursive Enumerable Language?

(c) Define NPC and NPH Class problem. What is the significance of NPC problem?

(d) Give Church Turing Thesis.

(e) Prove that Context Free Languages are closed

2. Attempt any four of the following. (5×4 = 20)

(a) Explain Ambiguous Grammar with example.

(b) Write short notes on Universal Turing Machine.

(c) Explain Halting Turing Machine Problem.

(d) Prove That DFA=NDFA.

(e) Remove $\in$-production

i. $S \rightarrow AB$

ii. $A \rightarrow aAA|\in$

iii. $B \rightarrow bBB|\in$

3. Attempt any two of the following. (10 × 2 =20)

(a) Show that $L=\{0^n \mid n$ is a positive integer and n is not prime$\}$ is not regular by using Pumping Lemma. Also Prove $L=\{a^{2n} \mid n \geq 1\}$ is regular.

(b) Write a regular expression for the following language over the alphabet {a, b}-

"The set of all strings not containing **bab** as a substring"

(c) Write short notes on Myhill-Nerode Theorem.

4. Attempt any two of the following. (10×2 =20)

(a) Design a Turing Machine that can compute proper subtraction i.e. m$n, where m and n are positive integers, m$n is defined as m-n if m>n and 0 if m<=n.

(b) Design a Turing Machine which recognize a string containing **aba** as a substring.

(c) What do you understand by undecidable problem? State the Halting problem and prove that Halting problem is undecidable.

5. Attempt any two of the following. (10×2 =20)

(a) Explain MPCP. Does the following PCP has a solution?

i. A = (10, 01, 0, 100, 1)

ii. B = (101, 100, 10, 0, 010)

(b) Construct a PDA accepting the following language:

i. $\{a^i b^j c^k \mid i \neq j \text{ or } j \neq k\}$

(c) Prove that the language

i. $L=\{0^n \mid n \text{ is prime}\}$ Is not regular.