SEM-IV COMP (CBSGS) 6/6/16

Theoretical Computer Science QP Code:541700

(3 Hours) | Total Marks :80

N.B. : (1) Question No. **1** is **compulsory**.
(2) Attempt any **three** questions out of remaining **five** questions.
(3) Assumptions made should be clearly stated.
(4) **Figure** to the **right** indicate **full** marks.
(5) **Assume** suitable **data** whenever required but justify that.

1. (a) Explain post correspondence problem. **5**
(b) Differentiate between NFA and DFA. **5**
(c) Show that language L = {0^i | i is prime number} is not regular **5**
(d) Compare recursive and recursively enumerable languages. **5**

2. (a) Design the DFA to accept all the binary strings over $\sum = \{0,1\}$ that are beginning with 1 and having its decimal value multiple of 5. **10**
(b) Design DPDA to accept language $L = \{x \in \{a, b\}^* \mid N_a(x) > N_b(x)\}$. **10**
$N_a(x) > N_b(x)$ means number of a's are greater than number of b's in string x.

3. (a) Explain variations and equivalence of Turing machine. **10**
(b) State and prove pumping lemma for context free languages. **10**

4. (a) Design mealy machine to find out 2's complement of a binary number. **10**
(b) Convert the following NFA to an equivalent DFA **10**

State	a	b	∈
$\rightarrow q_0$	$\{q_0, q_1\}$	$\{q_1\}$	{ }
q_1	$\{q_2\}$	$\{q_1, q_2\}$	{ }
$*q_2$	$\{q_0\}$	$\{q_2\}$	$\{q_1\}$

5. (a) Consider the following grammar G = (V, T, P,S) , V = {S, X}, T = {a,b} and productions P are **10**
$S \rightarrow aSb \mid aX$
$X \rightarrow Xa \mid Sa \mid a$
Convert this grammar in Greibach Normal Form (GNF).
(b) State and prove Rice's theorem. **10**

6. (a) Design a Tuning machine as an acceptor for the language $\{a^n b^m \mid n, m \geq 0 \text{ and } m \geq n\}$ **10**
(b) Design PDA to check even parentheses over $\Sigma = \{0,1\}$ **10**
