DHARMSINH DESAI UNIVERSITY, NADIAD
FACULTY OF TECHNOLOGY

B.TECH. SEMESTER V [Information Technology]

SUBJECT: (IT 511) Theory of Automata and Formal Language

Examination	**: Second Sessional**	**Seat No.**	**:**
Date	**: 06/09/2016**	**Day**	**:Tuesday**
Time	**: 11:00 to 12:15**	**Max. Marks**	**: 36**

INSTRUCTIONS:

1. Figures to the right indicate maximum marks for that question.
2. The symbols used carry their usual meanings.
3. Assume suitable data, if required & mention them clearly.
4. Draw neat sketches wherever necessary.

Q.1	**Do as directed.**		**[12]**
	(a)	The grammar below is ambiguous or not? Explain with suitable example S → 0A | 1B A → 0AA | 1S | 1 B → 1BB | 0S | 0	**[02]**
	(b)	Write a context free grammar that generates the set of all palindromes over the alphabet {0; 1}	**[02]**
	(c)	Consider the following grammar S → aB | bA B → b | bS | aBB A → a | aS | bAA Which of the following strings is generated by the grammar? (A) aaaabb (B) aabbbb (C) aabbab (D) abbbba	**[02]**
	(d)	Consider the production of the grammar S→ AA A→ aa A→ bb Which of the following valid strings set in the given language? (a.) L = {aaaa, aabb, bbaa, bbbb} (b.) L = {abab, abaa, aaab, baaa} (c.) L = {aaab, baba, bbaa, bbbb} (d.) L = {aaaa, abab, bbaa, aaab}	**[02]**
	(e)	Write a context free grammar for declaring a variable in C language.	**[02]**
	(f)	Write a CFG for the regular expression r = 0*1(0+1)*	**[02]**
Q.2			**[12]**
	(a)	Prove that the following languages are non regular 1) L = {w : #a(w) = #b(w)}. (#a(w) = the number of a's in w and #b(w) = the number of b's in w.) 2) L={0n 102n : n>=0}	**[06]**
	(b)	Consider the following Pushdown Automaton (PDA) P: P = (Q = {q0, q1, q2}, Σ = {a, b, c}, Γ = {a, #}, δ, q0, Z0 = #, F = {q2}) where the transition function δ is given by δ(q0, a, #) = {(q0, a#)} δ(q0, c, #) = {(q0, #)} δ(q0, a, a) = {(q0, aa)} δ(q0, b, a) = {(q1, ∧)} δ(q0, c, a) = {(q0, a)} δ(q1, c, #) = {(q1, #)} δ(q1, b, a) = {(q1, ∧)} δ(q1, c, a) = {(q1, a)} δ(q1, ∧, #) = {(q2, #)} δ(q, w, z) = Ø for all other combinations. Acceptance is by final state. Which of the following words are accepted by the PDA P? Prove your answers. (i) acabbc (ii) abcabc	**[06]**
	(c)	Convert the following CFG into an equivalent CFG in Chomsky normal form A) S →A | B| C A→aAa| B B→bB | bb C→aCaa| D D→baD| abD| aa B) S → BSB | B | ∧ B → 00 | ∧	**[06]**

Q.3			**[12]**

	(a)	Construct (deterministic or nondeterministic) pushdown automata that accept the following languages L1: $\{0^n1^m0^n : n \geq 1, m \geq 1\}$. L2: $\{0^{2n}1^n : n \geq 0\}$.	**[06]**
	(b)	Prove that context-free languages are closed under − a) Union b) Concatenation c) Kleene Star operation	**[06]**
		OR	
Q.3			**[12]**
	(a)	Consider the CFG G with productions S→ aB | bA | ∧ A→aS | bAA B→bS | aBB. Find the PDA corresponding to above grammar and trace it for the string "aababb."	**[06]**
	(b)	Construct pushdown automata to accept the following languages. L1: $\{1^n 0^n \mid n > 0\}$ L2: $\{0^n 1^{2n} \mid n \geq 0\}$	**[06]**