

B.E./B.TECH. Degree Examination, December 2020  
Fifth Semester  
**CS16503 -THEORY OF COMPUTATION**  
(Regulation 2016)

Time: Three hours

Maximum : 80 Marks

Answer **ALL** questions**PART A - (8 X 2 = 16 marks)**

1. A language is regular if and only if \_\_\_\_\_.  
A. accepted by DFA  
B. accepted by PDA  
C. accepted by LBA  
D. accepted by Turing machine
2. Which of the following is true?  
A. Every subset of a regular set is regular  
B. Every finite subset of non-regular set is regular  
C. The union of two non regular set is not regular  
D. Infinite union of finite set is regular
3. The behavior of a NDPDA can be stimulated by DPDA  
A. Always  
B. Sometimes  
C. Never  
D. Depend on NFA
4. Which of the following are the models equivalents to Turing machine?  
A. Multi tape turing machine  
B. Multi track turing machine  
C. Register machine  
D. All of the mentioned
5. Give the regular expression for set of all strings over {a,b} ending with aa.
6. Write the CFL for the given CFG.  
 **$S \rightarrow aB \mid bA$     $A \rightarrow a \mid aS \mid bAA$     $B \rightarrow b \mid bS \mid aBB$**
7. Write the Turing machine transition function for  **$f(x)=x+1$**
8. Find the solution for the following PCP problem

instance	List A	List B
	$W_i$	$X_i$
1	1	111
2	10111	10
3	10	0

**PART B - (4 X16 = 64 marks)**

09. (a) (i) Prove that the language  $L$  is accepted by the  $\xi$ -NDFFA if and only if  $L$  is accepted by some DFA. (8)

(ii) Construct the DFA over  $\{0\}$  for the language:  
 $L = \{0^n \mid n \bmod 5 = 2 \text{ where } n \geq 0\}$  and validate the string  $w$  for  $n=12$ . (8)

(OR)

(b) Obtain the NDFFA equivalent to the following  $\xi$ -NDFFA:

state	Input symbols			
	$\xi$	a	b	c
$\rightarrow p$	{q,r}	$\phi$	{q}	{r}
q	$\phi$	{p,r}	{p}	{q}
*r	$\phi$	$\phi$	$\phi$	$\phi$

10. (a) State and prove pumping lemma for regular language and also prove that  
 $L = \{0^p \mid p \text{ is a prime no.}\}$  is not regular. (16)

(OR)

(b) Convert the regular expression  $(0+1)^*(01)(0+1)$  into epsilon-NDFFA and find its equivalent minimized DFA. (16)

11. (a) (i) Prove that if  $P_N$  is a PDA that accepts a language with empty stack then there exists a PDA,  $P_F$  that also accepts the same language by entering into a final state. (8)

(ii) Design the PDA for the language,  $L = \{a^n b^{2n} \mid n \geq 1\}$  using empty stack. (8)

(OR)

(b) Construct the NPDA for the language,  $L = \{WW^R \mid W \text{ in } (0+1)^*\}$  and also describe the IDs for the string **010010**. (16)

12. (a) Design a Turing Machine to compute the language,  $L = \{a^n b^n c^n \mid n \geq 1\}$  (16)

(OR)

(b) Convert the following grammar into GNF  
 $S \rightarrow AB \quad A \rightarrow BS \mid b \quad B \rightarrow SA \mid a$  (16)