UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2017

Program: B.Tech (CSE+ All IBM courses)   Semester – V
Subject (Course): Formal Languages and Automata Theory   Max. Marks   : 100
Course Code   : CSEG345   Duration: 3 Hrs
No. of page/s: 2

NOTE:- Section A, Section B and Section C having 20, 40 and 40 Marks respectively. Section A is having 5 questions of 4 marks each. Section B is having 5 questions of 8 marks each and Section C(Internal Choice) is having 2 questions of 20 marks each. Answer should be point to point and precise.

Section – A (All Questions are compulsory)   [5*4=20]

1. Define Turing machine with transition function.

2. Eliminate all useless production from the grammar
   S=aS|AB
   A=bA
   B=AA
   What language does this grammar generate?

3. "If L1 and L2 (Compliment of L1) are recursive enumerable language then L1 and L2 both must be recursive language" justify the statement.

4. Explain Chomsky classification of Grammar.

5. "NPDA is more powerful then DPDA but DPDA is more efficient then NPDA" justify the statement with example.

Section B (Attempt the following)   [5*8=40]

6. Design a Moore M/c for a binary input sequence such that if it has a substring '101', the machine output is 'A'. if it has substring '110' its output is 'B', Otherwise its output is 'C'.

7. Design CFG for L={$a^m b^n c^k$,n=|m-k|}

**8.** Simplify given grammar and Convert to CNF

S=>abAB
A=>bAB| ε
B=>BAa|A| ε

9. Use the pumping lemma to show that following languages are not context free.
L1= {$a^i b^j$ / j=i^2}

10. Design DFA for language L= {w: na(w)mod3>nb(w)mod 3,w=$(a+b)^*$}

Section C (Attempt the following)   [2*20=40]

11. Design CFG and PDA for language
L={ $a^m b^n c^k$, m=n or n=k,m>0,n>0,k>0}
               OR
12. Design a Turing Machine for L={ ww^R ,w=$(a+b)^*$}

13. Explain closure properties of Following Language under Intersection, Union, Concatenation, Kleene closure and Complementation
    i)   Regular Language
    ii) CFL
    iii) Recursive Language
    iv) Recursive Enumerable Language

UPES
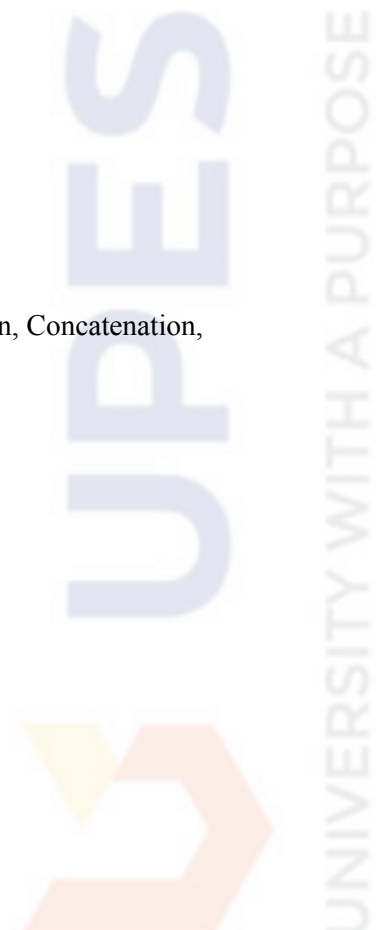
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2017

Program: B.Tech (CS+ All IBM courses)   Semester – V
Subject (Course): Formal Languages and Automata Theory   Max. Marks   : 100
Course Code   : CSEG345   Duration: 3 Hrs
No. of page/s: 2

NOTE:- Section A, Section B and Section C having 20, 40 and 40 Marks respectively. Section A is having 5 questions of 4 marks each. Section B is having 5 questions of 8 marks each and Section C(Internal Choice) is having 2 questions of 20 marks each. Answer should be point to point and precise.

Section – A (All Questions are compulsory)   [5*4=20]

1. "NPDA is more powerful then DPDA but DPDA is more efficient then NPDA" justify the statement with example.

2. "If L1 and L2 (Compliment of L1) are recursive enumerable language then L1 and L2 both must be recursive language" justify the statement with example.

3. Languages generated by the given grammar?
   $S \rightarrow aS|bS| \varepsilon$

4. Let $L \subseteq \sum^*$ where $\sum = \{a, b\}$. Which of the following is true?
    a). L= { x | x has an equal number of *a*'s and *b*'s } is regular
   b). L= { $a^n b^n$ | n $\geq$ 1 } is regular
   c). L= { x | x has more *a*'s than *b*'s } is regular
   d). L= {$a^n b^n$ | m,n is 3 digit prime number } is regular

5. State the Algorithm/Steps to Convert a CFG into Chomsky Normal Form

Section B (Attempt the following)   [5*8=40]

6. Explain Chomsky classification of Grammar with example.

7. Use the pumping lemma to show that following languages are not context free.

L1= $\{a^i b^j / j=i^3\}$

8. Design CFG for L=$\{a^m b^n c^k, n=m+k\}$

9. Simplify given grammar and Convert to CNF
S=>AB|aB
A=>aaB| ε
B=>bbA

10. Construct a DFA over the alphabet {a,b} which does not contain the substring **baba**.

Section C (Attempt the following)   [2*20=40]

11. Design CFG and PDA for language
L=$\{a^m b^n c^k, m=n \text{ or } n=k\}$

OR

12. Design a Turing Machine for L=$\{a^m b^n c^k, m=n=k\}$

13. Explain closure properties with of Following Language under Intersection, Kleene closure, Concatenation, Kleene closure and Complementation
a. Regular Language
b. CFL
c. Recursive Language
d. Recursive Enumerable Language