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# B.M.S. College of Engineering, Bengaluru-560019

**Autonomous Institute Affiliated to VTU**

## August 2024 Supplementary Examinations

**Programme: B.E.** **Semester: IV**
**Branch: Computer Science and Engineering** **Duration: 3 hrs.**
**Course Code: 19CS4PCTFC** **Max Marks: 100**
**Course: Theoretical Foundations of Computations**

**Instructions**: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

**Important Note:** Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

| | | UNIT - I | CO | PO | Marks |
|---|---|---|---|---|---|
| 1 | a) | i. Design a FA with ∑ = {0, 1} accepts the strings with an even number of 0's followed by single 1.<br>ii. Design an NFA with ∑ = {0, 1} accepts all string in which the third symbol from the right end is always 0. | CO2 | PO 2 | 8M |
| | b) | Convert the following NFA to DFA<br>\| \| 0 \| 1 \|<br>\|->p \| {q,s} \| {q} \|<br>\|*q \| {r} \| {q,r} \|<br>\|r \| {s} \| {p} \|<br>\|*s \| ∅ \| {p} \| | CO2 | PO2 | 8M |
| | c) | Write any four differences between NFA, DFA? | CO1 | PO1 | 4M |
| | | **UNIT - II** | | | |
| 2 | a) | i. Write the regular expression for the language starting with a but not having consecutive b's.<br>ii. Write the regular expression for the language having a string which should have at least one 0 and at least one 1.<br>iii. Write the regular expression for the language L over ∑ = {0, 1} such that all the string does not contain the substring 01.<br>iv. Write the regular expression for the language containing the string in which every 0 is immediately followed by 11.<br>v. Write the regular expression for the language starting and ending with a and having any having any combination of b's in between. | CO2 | PO2 | 10M |
| | b) | Prove that L={$a^n b^1 c^{n+1}$\| n,1>=0} is not regular | CO2 | PO2 | 5M |
| | c) | Obtain an NFA for the regular expression a*+b*+c* | CO3 | PO3 | 5M |

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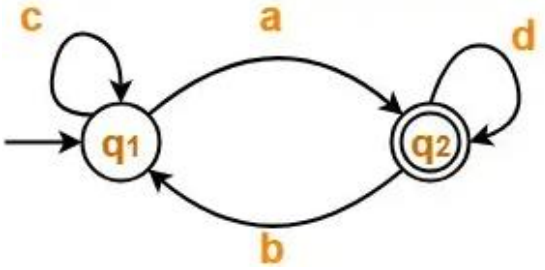
| | | | **OR** | | | |
| | 3. | a) | i. Write the regular expression from the given DFA   ii Obtain the regular expression for the following<br>a. string's of a's and b's of length <=10<br>b. string's of a's and b's ending with b and has no substring aa | *CO3* | *PO3* | **10M** |
| | | b) | Prove that "The set of regular languages is closed under complementation" | *CO2* | *PO2* | **5M** |
| | | c) | Prove that L={$a^n b^n$ where n>=1} is not regular. | *CO2* | *PO2* | **5M** |
| | | | **UNIT - III** | | | |
| | 4 | a) | i. Obtain a CFG to generate a string of balanced parenthesis<br>ii Obtain the grammar to generate the language L={$a^n b^{n-3}$\|n>=3} | *CO2* | *PO2* | **8M** |
| | | b) | Show that the following grammar is ambiguous over w= (( ) ( ) ( ))<br>S → SS/ (S)/ ε | *CO2* | *PO2* | **6M** |
| | | c) | Eliminate useless symbols in the following grammar<br>S -> aA \|bB<br>A ->aA \| a<br>B -> bB<br>D ->ab \|Ea<br>E -> aC\|d | *CO2* | *PO2* | **6M** |
| | | | **OR** | | | |
| | 5 | a) | i.Obtain the leftmost derivation for the string "aaabbabbba" using the following grammar<br>S->aB\|bA<br>A->aS\|bAA\|a<br>B->bS\|aBB\|b<br><br>ii. obtain CFG to generate a set of all strings with exactly on a when Σ={a,b} | *CO3* | *PO3* | **8M** |
| | | b) | Convert the following grammar to Greibach Normal Form<br>S->AB1 \| 0<br>A->00A\|B<br>B->1A1 | *CO2* | *PO2* | **6M** |
| | | c) | Eliminate the unit productions from the grammar<br>S->A0\|B<br>B->A\|11<br>A->0\|12\|B | *CO2* | *PO2* | **6M** |

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| | | | **UNIT - IV** | | | |
| | 6 | a) | Construct PDA to recognize the language $L=\{a^n b^{2n}, n>=1\}$ by empty stack method. Give the graphical representation of the PDA obtained. | ***CO3*** | ***PO3*** | **10M** |
| | | b) | Design DPDA for the language $L=\{WcW^R, W \in (a+b)^*\}$ by empty stack. | ***CO3*** | ***PO3*** | **10M** |
| | | | **UNIT - V** | | | |
| | 7 | a) | Designing Turing Machine for $L= \{0^n 1^n, n>=1\}$ | ***CO3*** | ***PO3*** | **10M** |
| | | b) | Design TM which accepts the set of all palindromes over {0, 1} | ***CO3*** | ***PO3*** | **10M** |

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