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| Name: Enrolment No: |  |
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UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2022

Course: Formal Languages & Automata Theory

Semester: III

Program: B.Tech CSE (Hons.) All Branches

Time : 03 hrs.

Course Code: CSEG 2035P

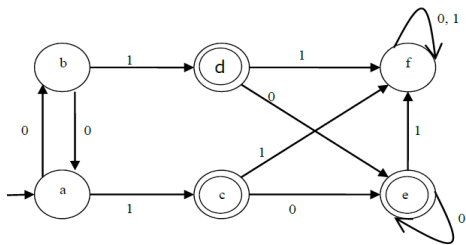
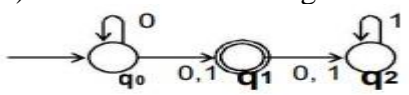
Max. Marks: 100

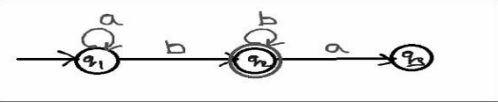
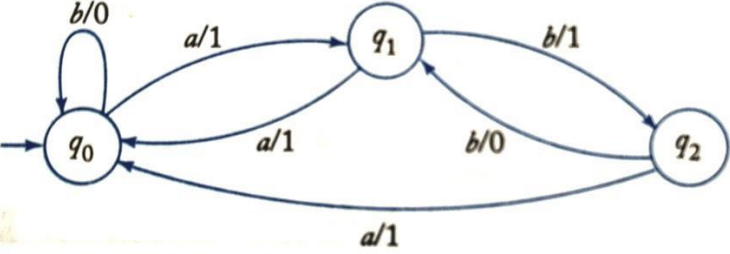
Instructions:

SECTION A
(5Qx4M=20Marks)

| S. No. | Question | Marks | CO |
|--------|---|-------|-----|
| Q 1 | Prove that the complement of a regular language is also regular. | 4 | CO2 |
| Q 2 | Construct a DFA for the language over $\{0, 1\}^*$ such that it contains "000" as a substring. | 4 | CO1 |
| Q 3 | Construct a ϵ -NFA for the following regular expression. $(0+1)^*(00+11)(0+1)^*$ | 4 | CO2 |
| Q 4 | State the pumping lemma for regular languages. Discuss the applications of regular expression? | 4 | CO2 |
| Q 5 | State the relations among regular expression, deterministic finite automata, non-deterministic finite automaton and finite automaton with epsilon transition. | 4 | CO1 |

SECTION B
(4Qx10M= 40 Marks)

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| Q 6 | <p>a) Minimize the DFA shown in the following diagram.</p> <div style="text-align: center;">  </div> <p>b) Convert the following NFA into an equivalent DFA.</p> <div style="text-align: center;">  </div> | 10 | CO1 |
|-----|--|-----------|------------|

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| Q 7 | Construct a regular expression for the given finite automata using state elimination method. <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;">  </div> | 10 | CO2 |
| Q 8 | Convert the following grammar into an equivalent one with no unit productions and no useless symbols $S \rightarrow ABA$, $A \rightarrow aAA aBC bB$, $B \rightarrow A bB Cb$, $C \rightarrow CC Cc$ | 10 | CO3 |
| Q 9 | Convert the Mealy machine into equivalent Moore machine. <div style="text-align: center; margin: 10px auto;">  </div> | 10 | CO1 |
| SECTION-C (2Qx20M=40 Marks) | | | |
| Q 10 | a) Design a PDA automata which accepts $L = \{0^n 1^n \mid n \geq 1\}$. b) Design a PDA for the grammar: $S \rightarrow aABC$ $A \rightarrow aB a$ $B \rightarrow bA b$ $C \rightarrow a$ | 20 | CO3 |
| Q 11 | a) Design a Turing Machine that recognizes the language consisting of all strings of 0's whose length is a power of 2 i.e. $L = \{0^{2^m} \mid m \geq 0\}$. b) Write short notes on the following: i) Recursive and Recursive enumerable language ii) Decidable and undecidable language | 20 | CO4 |