**Name:**

**Enrolment No:**

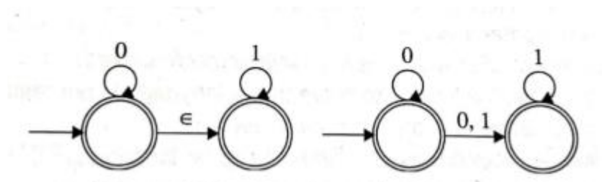
UPES

# UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

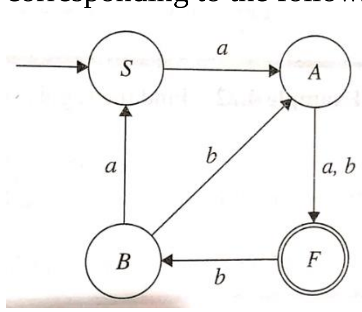
**End Semester Examination, December 2019**

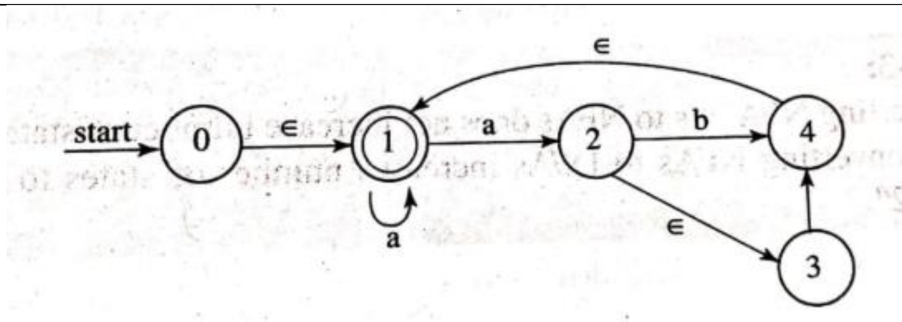
**Course: Formal Language and Automata (CSEG3004)**
**Semester: V**
**Programme: B.Tech (CS+ All IBM courses)**
**Time: 03 hrs.** **Max. Marks: 100**

## SECTION A

| S. No. | | Marks | CO |
|---|---|---|---|
| Q 1 | Check if the two finite automata given in the following figures are equivalent. Give reason to support your answer.   | **4** | **CO1** |
| Q 2 | Differentiate between FA/PDA vs. TM with respect to:<br>a) Tape and head<br>b) Halt state and final state | **4** | **CO4** |
| Q 3 | Discuss P, NP and NPC class problem. | **4** | **CO4** |
| Q 4 | How many different DFA can be designed with fixed initial states over $\sum=\{a,b\}$ and number of states are 2. | **4** | **CO1** |
| Q 5 | Design a Moore machine for recognizing all even integers between 100 and 1000. | **4** | **CO2** |

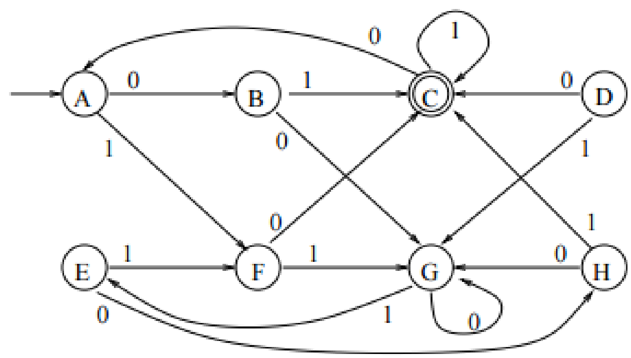
## SECTION B

| | | | |
|---|---|---|---|
| Q 6 | Construct a Turing machine that finds the product of two natural numbers. | **10** | **CO4** |
| Q 7 | Convert the following grammar into CNF:<br>$A \rightarrow BAB \mid B \mid \varepsilon$<br>$B \rightarrow 00 \mid \varepsilon$ | **10** | **CO3** |
| Q 8 | Find the regular expression corresponding to the following automata:   | **10** | **CO2** |
| Q 9 | Convert the NFA- ε,given in the following figure, to DFA. | **10** | **CO1** |

<table>
<tr><td></td><td>



OR

Construct a minimum state automata for the following DFA-



</td><td></td><td></td></tr>
<tr><td colspan="4">SECTION-C</td></tr>
<tr><td>Q 10</td><td>For the following regular expression, draw a ε-NFA and convert into the equivalent DFA.<br>a) (a+b)*(abb+ababab)(a+b)*<br>b) (ε + 0+1+00+01+11+10) ( (0+1) 0+1)*)</td><td>20</td><td>CO2</td></tr>
<tr><td>Q 11</td><td>Write transition rules for a PDA corresponding to the following Context Free Language:<br>$L = \{ wcw^R \mid w$ is in $(0+1)^*$ and $w^R$ represents reverse $w\}$.<br>Also, obtain Context Free grammar for this PDA.<br>OR<br>Write the CFG for the following language:<br>i) $L= \{ a^x b^y \mid x \neq y\}$<br>ii) $L = \{ a^n b^m c^m a^n \mid n, m >= 1\}$<br>iii) $L = \{ (a^n b^n c^m d^m \mid n>= 1, m>=1) \cup (a^n b^m c^m d^n \mid n>= 1, m>=1) \}$<br>iv) $L= \{ 0^i 1^j 2^k \mid k<=i \text{ or } k <= j\}$</td><td>20</td><td>CO3</td></tr>
</table>