BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

SEMESTER : II
SESSION : SP/2023

CLASS: MCA
BRANCH: MCA

SUBJECT: CA417 THEORY OF COMPUTATION

FULL MARKS: 50

TIME: 3 Hours

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

---

| | | | CO | BL |
|---|---|---|---|---|
| Q.1(a) | Are both the languages: L1 = {ab, aabb, aaabbb, aaaabbbb}. L2 = {w \| w ∈ (a + b) * and the number *a*'s in w is equal to number of *b*'s in w} countable or not? Justify. Differentiate between empty string and empty language. | [5] | CO-1 | Understand |
| Q.1(b) | Discuss how the concept of set, function and graph are used in Automata theory. Does $L^1$ (where L is the original language) mean the set of strings, each of length 1? Justify. | [5] | CO-1 | Understand |
| Q.2(a) | Draw the DFA for the languages: (a) Φ (b) {ε }, (c) $\Sigma^+$ (d) strings not ending with 00 over the alphabet {0. 1}. | [5] | CO-2 | Understand |
| Q.2(b) | Discuss the drawbacks of NDFA. Consider two DFAs (M and N) over {a, b}, where M accepts strings ending with *a* and N accepts strings ending with *b*. Find the minimal DFA that accepts L(M) ∩ L(N). | [5] | CO-2 | Apply |
| Q.3(a) | Define formal grammar. Find the language generated by the grammar with rules: S→ aAa, A→ aAa, A→ a, where S is the start symbol. Explain the importance of GNF. | [6] | CO-2 | Understand |
| Q.3(b) | Design a simple set of CFG rules for checking the validity of the declaration statement for C-language. | [4] | CO-2 | Apply |
| Q.4(a) | Differentiate between FA and PDA. Design a PDA to recognize a language of matched parenthesis. | [5] | CO-3 | Understand |
| Q.4(b) | Give the general form of the transition function for a TM and demonstrate that the TM is more powerful than PDA. Design a single tape TM to add two *positive* integers. | [5] | CO-3 | Apply |
| Q.5(a) | Are the number of languages and the number of Turing machines are equal? Justify. | [3] | CO-5 | Apply |
| Q.5(b) | Discuss briefly about P-class and NP-class problem based on the concept of TM. | [5] | CO-5 | Apply |

::::::26/04/2023::::::E