# K. K. Wagh Institute of Engineering Education & Research, Nashik

(An Autonomous Institute From A.Y. 2022-23)

| WINTER-2025 | |
|---|---|
| Exam Seat No.: | |
| Academic Year:2025-2026 | Semester:V |
| Class:TY | Program:B.Tech |
| Branch Code:INT | Pattern:2023 |
| Name of Course:Theory of Computation | Course Code:2308301 |
| Max. Marks:60 | Duration:2.30 Hrs. |

**Instructions:** Candidates should read carefully the instructions printed on the Question Paper and on the cover page of the Answer Book, which is provided for their use.

1. This question paper contains 02 page(s).
2. Answer to each new question is to be started on a new page.
3. Assume suitable data wherever required, but justify it.
4. Draw the neat labelled diagrams, wherever necessary.
5. The last columns indicates the Course Outcome and level of Blooms Taxonomy of the Question/sub-question.

**Marks CO**

**Question No. 1**

a) Convert following non-deterministic finite automata to its equivalent deterministic finite automata. (6) CO1

| **↓Q Σ →** | **a** | **b** |
|---|---|---|
| **→$q_0$** | $q_0q_1$ | $q_2$ |
| **$q_1$** | $q_0$ | $q_1$ |
| **$q_2$*** | Φ | $q_0q_1$ |

**Question No. 2**

b) Prove the following: (6) CO2

i) If L1 and L2 are two regular languages then L1 U L2 is regular.

ii) The complement of regular language is regular.

iii) If L1 and L2 are two regular languages then L1 ∩ L2 is regular.

**Question No. 3**

a) Recognize the language L from CFG: G = [{S}, {a, b}, P, {S}] where P = S → aSB; S → ab (5) CO3

**OR**

b) Check whether the given grammar is ambiguous or not. (5) CO3

S → iCtS

S → iCtSeS

S → a

C →b

c) Construct context free grammar for the language in which there are no consecutive b's, the strings may or may not have consecutive a's. (5) CO3

**OR**

d) Convert given left linear grammar to right linear grammar. (5) CO3

S → B1 | A0 | C0

A → C0 | A1 | B1 | 0

B → B1 | 1

C → A0

e) Convert the following grammar to Greibach Normal Form. (6) CO3

G = S → abSb | aa

**OR**

f) Simplify the following grammar: (6) CO3

S → ASB | ϵ

A → aAS | a

B → SbS | A | bb

**Question No. 4**

a) Construct a push down automata which accepts the language denoted by the following grammar: S → aSa | bSb | a | b | ϵ (8) CO4

**OR**

b) Construct a PDA that accepts the language L = $\{a^n b^n \mid n \geq 0\}$ (8) CO4

c) Design a post machine to accept palindrome strings over Σ = {a, b}. (8) CO4

**OR**

d) Design post machine to accept a language L = $\{a^n b^n c^n \mid n \geq 0\}$. (8) CO4

**Question No. 5**

a) Construct a Turing machine for the language of even number of 1's and even number of 0's over Σ = {0, 1}. (8) CO5

**OR**

b) Design a Turing machine that replaces all occurrences of '111' by '011' from a sequence of 0's and 1's. (8) CO5

c) Compare finite state machine, push down automata, post machine and Turing machine with respect to language, grammar, powerfulness and examples. (8) CO5

**OR**

d) Design a Turing machine to recognize an arbitrary string divisible by 4 from Σ = {0, 1, 2}. (8) CO5

**····· End of question paper·····**