



# ABV- Indian Institute of Information Technology & Management, Gwalior

## Theory of Computation (IT206)

Minor Examination (Session 2024–25)

Maximum Time: 1.5 Hours

Max Marks: 25

**Note: Answer precisely. Diagrams and formal definitions will carry additional credit.**

1. (a) Define Deterministic Finite Automata (DFA) formally. (b) Construct a DFA over  $\{0, 1\}$  that accepts all strings ending with 01. (5 Marks)
2. (a) State and prove the closure properties of regular languages (any three). (b) Give an example of a non-regular language and explain using Pumping Lemma. (5 Marks)
3. Convert the following NFA into an equivalent DFA using the subset construction method:  
$$Q = \{q_0, q_1, q_2\}, \quad \Sigma = \{a, b\}, \quad q_0 \text{ start}, \quad F = \{q_2\}$$
  
Transitions: -  $\delta(q_0, a) = \{q_0, q_1\}$  -  $\delta(q_1, b) = \{q_2\}$  -  $\delta(q_2, a) = \{q_2\}$  (5 Marks)
4. (a) Define Context-Free Grammar (CFG). Construct a CFG for  $L = \{a^n b^n \mid n \geq 1\}$ . (b) Show that the language  $L = \{a^i b^j c^k \mid i = j \text{ or } j = k\}$  is context-free but not regular. (5 Marks)
5. Write short notes on any **two**: (i) Equivalence of DFA and NFA (ii) Chomsky Normal Form (iii) Applications of Automata Theory in real life (5 Marks)