

GYANMANJARI INNOVATIVE UNIVERSITY

GYANMANJARI INSTITUTE OF TECHNOLOGY

B.Tech.-Mid Semester Examination (MSE)- S2026

Enrollment No.: _____

Subject Code: BETCE16325

Date: 16/03/2026

Subject Name: Theory of Computation

Semester: 6th

Time: 2:30 pm to 4:30 pm

Total Marks: 60

Instructions:

1. Question No. 1 is compulsory.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

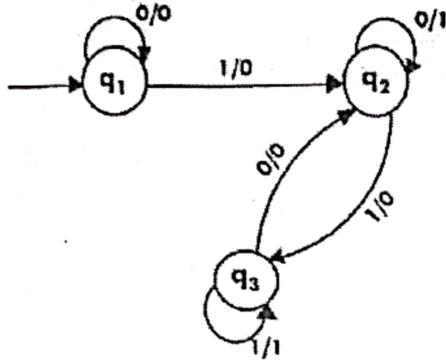
	Marks
Q.1 (a) Explain <i>Kleene closure</i> $(\Sigma)^*$ in detail. List Σ^* , Σ^+ for $\Sigma = \{a,b\}$ up to length 3 and differentiate between them.	05
(b) State Rice's Theorem. Explain the difference between trivial and non-trivial properties of recursively enumerable languages with examples.	05
(c) Let, $L_1 = \{a,b\}$ AND $L_2 = \{b,c\}$. Find and explain: 1. Union 2. Intersection 3. Concatenation 4. Difference 5. kleene closure	10
Q.2 (a) Write a regular expression for below: (a). Strings over $\{0,1\}$ starting with 11 and ending with 11. (b). Strings over $\{a,b\}$ starting and ending with a.	05
(b) If $L = \{a^n b^m c^q \mid n,m,q \geq 0\}$ than draw a minimal DFA for this and also give answer for below. (a) Count number of states in minimal DFA. (b) Count number of states in minimal NFA.	05

OR

- (b) Construct DFA and Regular Expression for:
Strings over $\{a,b\}$ starting and ending with a. and also give the answer for below.
(a) Count number of states in minimal DFA. 05
(b) Count number of states in minimal NFA.
- (c) Let, $L = \{10^n 1 \mid n \geq 1\}$
a) Find the Minimum Pumping Length (MPL) of L.
b) Verify the pumping property for a string whose length \geq MPL. 10

OR

- (c) Convert the following Mealy machine into an equivalent Moore machine. Also construct the state table of the Moore machine and show the output sequence for input string 0101.



10

- Q.3 (a) Design a PDA for the following language.
 $L = \{a^n b^n \mid n > 0\}$

05

- (b) For each of the following languages, determine whether it is Regular (RL), Context-Free (CFL), Deterministic CFL (DCFL), Context-Sensitive (CSL), or Not CFL.

- (1) $L_1 = \{a^n b^n \mid n \geq 0\}$
- (2) $L_2 = \{a^n b^m \mid n, m \geq 0\}$
- (3) $L_3 = \{a^n b^n c^n \mid n \geq 0\}$
- (4) $L_4 = \{a^p \mid p \text{ is prime}\}$
- (5) $L_5 = \{w \in \{a, b\}^* \mid n_a(w) = n_b(w)\}$

05

- (c) Convert the following CFG into its equivalent PDA.

$S \rightarrow AB$
 $A \rightarrow BB$
 $B \rightarrow AB$
 $A \rightarrow a$
 $B \rightarrow ab$

10

OR

- Q.3 (a) Construct CFG for $L = \{a^n b^m \mid n \geq m\}$.

05

- (b) Write a grammar in Backus-Naur Form (BNF) for a language of strings over $\Sigma = \{a, b\}$ such that every string starts with "a" and ends with "b".

05

- (c) Convert the following grammar to a PDA:

$I \rightarrow a \mid b \mid Ia \mid Ib \mid I0 \mid I1$
 $E \rightarrow I \mid E * E \mid E + E \mid (E)$

10