DHARMSINH DESAI UNIVERSITY, NADIAD
FACULTY OF TECHNOLOGY
COMPUTER ENGINEERING
FIRST SESSIONAL
SUBJECT: (CE-422) DISCRETE MATHEMATICS

Examination	**: B.Tech Semester – IV**	**Seat No.**	**:**
Date	**: 02, Jan 2023**	**Day**	**: Tuesday**
Time	**: 01:00 to 02:15 PM**	**Max. Marks**	**: 36**

INSTRUCTIONS:
1. Figures to the right indicate maximum marks for that question.
2. The symbols used carry their usual meanings.
3. Assume suitable data, if required & mention them clearly.
4. Draw neat sketches wherever necessary.

Q.1 Do as directed. **[12]**

CO1	U	(a)	Write a compound proposition statement that is true when exactly two of the three statements p,q,r are true.	[1]
CO1	A	(b)	Given that the value of $p \rightarrow q$ is false, determine the value of $(\bar{p} \vee \bar{q}) \rightarrow q$.	[1]
CO2	U	(c)	Let R be a binary relation on the set of all positive integers such that $R = \{(a,b) \mid a - b \text{ is odd positive integer}\}$ Is R Reflexive? Symmetric? Antisymmetric?	[2]
CO2	R	(d)	Define Transitive Closure with suitable example.	[2]
CO4	A	(e)	Find the language recognized by the deterministic finite-state automaton given in Fig (a).	[2]
CO4	U	(f)	Let $X = \{y \mid y \notin y\}$. Can we say $\{p,q\} \in X$? Can we say $X \in X$? Justify.	[2]
CO4	R	(g)	Define: Phrase Structure Grammar. What is the purpose of it?	[2]

Q.2 Attempt ***Any THREE*** from the following questions. **[12]**

CO1	A	(a)	Show that $1*1! + 2*2! + 3*3! + \ldots + n*n! = (n+1)! - 1$ Using mathematical induction. ($n>=1$)	[4]
CO1	A	(b)	Prove that $n(n+2)$ is divisible by 4 for all positive even integers by mathematical induction. ($n>=2$)	[4]
CO2	A	(c)	85 children went to an amusement park where they could ride on Roller-coaster, Giant wheel and Toy-train. 20 of them took all the three rides and 55 of them took at least two of three rides. Each ride costs Rs. 10 and total receipt of the amusement park from children was Rs. 1,450. How many children did not try any of these rides?	[4]
CO2	U	(d)	Let A ={a,b,c,d}.Relation R is defined on set A. R={(a,b),(b,c),(c,d)(d,b)}. Find transitive closure using Warshall's algorithm for the given relation R.	[4]

Q.3 Attempt the following questions. **[12]**

CO4	A	(a)	Design a finite state machine with {α, β} as its input alphabet and {α, β, γ} as its output alphabet such that for any input sequence the corresponding output sequence will consist of two γs followed by the input sequence delayed by one time unit. Input: β α α α β α β β β α α β Output: γ γ β α α α β α β β α	[6]
CO4	U	(b)	For the following grammars determine the type of the corresponding grammar and the type of the corresponding language. Justify your answer. G1 = {S→abc, S→aAbc, Ab→bA, Ac→Bbcc, bB→Bb, aB→aa, aB→aaA} G2 = {S→AB, AB→BA, A→a, B→b} G3 = {S→ABC, A→a, A→b, aB→b, bB→a, bC→a, aC→b}	[6]

OR

Q.3 Attempt the following questions. **[12]**

CO4 A (a) Find a deterministic finite state machine that recognizes L. [6]

$L = \{0^i 1 0^j | i \geq 1, j \geq 1\}$

CO4 U (b) For the finite state machine shown in Fig (b), where C is the starting state. [6]

- List all 0-equivalent states.
- Find all equivalent states and obtain an equivalent finite state machine with least possible states.

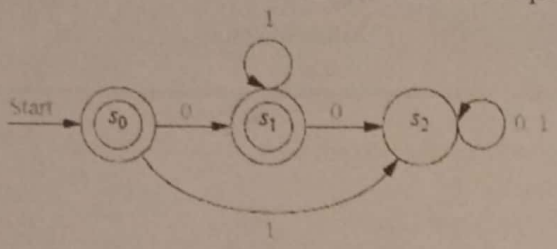

Fig (a)

	Input		
State	0	1	Output
A	G	F	0
B	A	F	1
⇨ C	A	B	0
D	H	B	1
E	A	G	0
F	H	H	1
G	A	E	0
H	A	C	1

Fig (b)