PEC UNIVERSITY OF TECHNOLOGY
Mid-Term Examination

Programme: B.E. (CSE) | **Year/Semester: 3rd Semester**
Course Name: Discrete Structures for Computer Science | **Course Code: CSN201**
Maximum Marks: 30 | **Time allowed: 1 Hr 30 Minutes**
Notes:

- All questions are compulsory.
- Unless stated otherwise, the symbols have their usual meanings in context with subject. Assume suitably and state, additional data required, if any.

Q. No.		Mark
1.	a) Let $E(x)$ be the predicate "x is an employee", $M(x)$ the predicate "x is a manager" and $Q(x, y)$ the predicate "x has asked y a question". Use quantifiers and logical connectives to express each of following sentences, where the domain consists of all members of your company. i) Employee Ajay has asked Managing Director Nitin a question. ii) Every employee has asked Manager Nandan a question. iii) Some employee has not asked any manager a question. iv) There is a manager who has never been asked a question by an employee.	4
	b) What makes an argument a "valid argument"? Determine whether following argument is valid or not. Mathematics is not easy or students like logic. If mathematics is not easy then students like logic. Mathematics is easy. Therefore, students don't like logic.	1+2
	c) Let a relation R is defined on $\mathbb{N}$ as $\forall\, c, d \in \mathbb{N} \quad (c, d) \in R$ iff $c + d$ is even. Is R an equivalence relation? Justify and if yes, how many equivalence classes does R have?	4
	d) A certain company wants to have security for their computer systems. So they have given everyone a name and password. A length 10 word containing each of the characters: $a, d, e, f, i, l, o, p, r, s$ is called a *cword*. A password will be a *cword* which does not contain any of the sub-words "fails", "failed", or "drop". Find the total number of possible passwords using the inclusion-exclusion principle.	4
2.	a) Consider the POSET $(\{1, 2, 3, 6, 12, 24, 36, 48\}, \mid)$, where $\mid$ is the "divides" operator. i) List the elements of the poset and draw its Hasse diagram. ii) Find its maximal elements, minimal elements, greatest and least elements, if exist. iii) Compute lower bounds, upper bounds, greatest lower bound and least upper bound of the subset $M = \{3, 6, 12\}$, if exist. iv) Is it a lattice? Justify.	2+3=
	b) Use Mathematical Induction to prove that $2^n > n^2$ if n is an integer greater than 4.	4
	c) Consider following premises and conclusion in predicate logic, where x, y are variables and $Amit, a, b$ are constants. Use resolution refutation method to determine validity of the given conclusion. Draw resolution tree. P1: $hound(x) \rightarrow howl(x)$ P2: $(have(x, y) \wedge cat(y)) \rightarrow \neg(have(x, z) \wedge mouse(z))$ P3: $ls(x) \rightarrow \neg(have(x, y) \wedge howl(y))$ P4: $have(Amit, a) \wedge (cat(a) \vee hound(a))$ Conclusion: $ls(Amit) \rightarrow \neg(have(Amit, b) \wedge mouse(b))$	6