3rd Sem (Regular)
Discrete Mathematics
MA 2013

(Branch)

AUTUMN END SEMESTER EXAMINATION-2019

3rd Semester B.Tech & B.Tech Dual Degree

Discrete Mathematics

MA 2013

(For 2018 Admitted Batches)

Time: 3 Hours | Full Marks: 50

Answer any SIX questions.
Question paper consists of four sections-A, B, C, D.
Section A is compulsory.
Attempt minimum one question each from Sections B, C, D.
The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable and *<u>all parts of a question should be answered at one place only</u>.*

SECTION-A			
1.			[1 × 10]
	(a)	Tell the truth value of the statement “if monkey can fly then Rahul is in Japan” with reason.	
	(b)	Recall the law of resolution in rules of inference.	
	(c)	Find a domain for which the statement “$\forall x\ (x^2 \leq x)$” is true.	
	(d)	List the order pairs in the equivalence relation produced by the partition $A_1 = \{1, 2, 3, 4\}$ and $A_2 = \{a, b\}$ of $A = \{1, 2, 3, 4, a, b\}$.	
	(e)	Find least upper bound and greatest lower bound of $\{126, 154\}$in the poset $(Z^+, \mid)$.	
	(f)	Classify the function $f: R \rightarrow R$, defined by $f(x) = x^3 - x$ for all $x \in R$, as one-one, onto or both one-one and onto.	

	(g)	Explain the generating function for the numerical sequence (n).	
	(h)	Give an example of a semigroup which is not a group.	
	(i)	Find an example of normal subgroup.	
	(j)	Find the inverses of 4 in the field $(Z_5, \oplus, \odot)$.	

SECTION-B

2.	(a)	Show that the compound proposition $(p \rightarrow q) \wedge (p \wedge \sim q)$ is a contradiction.	[4]
	(b)	Applying method of substitution, find the numeric sequence (a_n) that satisfy the recurrence relation $a_n = 4a_{n-1} - 4a_{n-2}$ for $n \geq 1$, $a_0 = 4$, $a_1 = 1$.	[4]
3.	(a)	i) Find fog and gof, where $f(x) = x^2 + 1$ and $g(x) = x + 2$, are functions from R to R. ii) Identify whether the permutation $(1\ 2\ 3\ 4\ 5\ 6\ 2\ 4\ 6\ 5\ 1\ 3)$ is even or odd.	[4]
	(b)	Show that the set of all even integers is semigroup under usual multiplication. Is it a monoid?	[4]

SECTION-C

4.	(a)	Assume $a_n = 5a_{n-1} - 6a_{n-2}$, for $n \geq 2$ with $a_0 = 2$ and $a_1 = 5$. Show that $a_n = 2^n + 3^n; n \geq 0$ using strong induction.	[4]
	(b)	Apply Warshall's Algorithm to find the transitive closure of the relation $R = \{(1, 2), (1, 3), (1, 4), (2, 3), (2, 4), (3, 4)\}$ on $\{1, 2, 3, 4\}$.	[4]

5.	(a)	Show that the inclusion relation $\subseteq$ is a partial ordering on the power set of a set. Draw the Hasse diagram for this partial ordering on the power set of $\{a, b, c\}$.	[4]
	(b)	Construct examples of a distributive lattice and a complemented lattice.	[4]
6.	(a)	Let G be the set of all nonzero real numbers and let $a * b = \frac{ab}{2}$. Test $(G, *)$ for an abelian group.	[4]
	(b)	(i) Define zero divisor in a ring. Identify a zero divisor in the ring of all 2×2 real matrices under usual addition and multiplication of matrices (ii) Define an integral domain with suitable examples.	[4]

SECTION-D

7.	(a)	Examine whether these system specifications are consistent: "The diagnostic message is stored in the buffer or it is retransmitted." "The diagnostic message is not stored in the buffer." "If the diagnostic message is stored in the buffer, then it is retransmitted."	[4]
	(b)	Let H_n denote the number of moves needed to solve the Tower of Hanoi problem with n disks. Determine a recurrence relation for the sequence H_n and solve using generating function.	[4]
8.	(a)	Let n be a positive integer and S a set of all bit strings. Construct an equivalence relation R_n on S. What are the sets in the partition of S arising from the relation R_3 on S?	[4]
	(b)	Let G be a group. Prove that the function $f: G \rightarrow G$ defined by $f(a) = a^2$ is a homomorphism if and only if G is abelian.	[4]

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MAPPING OF QUESTIONS WITH COURSE OUTCOMES AND LEARNING LEVELS

The paper setter /Moderator will provide mapping of Question with Course Outcomes and learning levels in the following format:

Course Name: Discrete Mathematics
Course code: MA 1013
Examination: AUTUMN END SEMESTER 2019

CO1	convert sentences in natural language into mathematical statements, understand predicate and quantifiers, rules of inference and prove results by principle of mathematical induction.
CO2	understand the principles of inclusion and exclusion of sets, concept of relations and functions and solve related problems.
CO3	know the concepts of partition of sets, partial ordering relation, Hasse diagram and Lattice.
CO4	solve problems on recurrence relations by substitution and method of generating functions.
CO5	understand the concept of algebraic structures, semi groups, group, subgroups and proof of Lagrange theorem.
CO6	gets the idea of homomorphism and isomorphism of groups,

Rows may be added or deleted as necessary

Question number	Course Outcome number	Learning Level (Blooms taxonomy)
Section A		
Q1a	CO1	L1; Tell
1b	CO1	L1; Recall
1c	CO2	L1; Find
1d	CO3	L1; List
1e	CO3	L1; Find
1f	CO2	L2; Classify
1g	CO4	L2; Explain
1h	CO5	L2; example
1i	CO5	L1; Find
1j	CO5	L2; Find
Section B		
Q2a	CO1	L2; Show
2b	CO2	L3; Applying
Q3a	CO4	L3; Identify
3b	CO5	L2; Show
Section C		
Q4a	CO1	L4; Assume
4b	CO2	L3;apply
Q5a	CO3	L4; draw
5b	CO3	L3; Construct
Q6a	CO5	L4; Test for
6b	CO5	L3; Identify
Section D		
Q7a	CO1	L4; Examine
7b	CO4	L5; Determine
Q8a	CO3	L6; Construct
8b	CO6	L5; Prove

Signature of Paper Setter/Moderator

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