

**BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE::ODALAREVU
(AUTONOMOUS)**

II-B.Tech II-Semester Supplementary Examinations (BR20), NOV - 2022

MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE (CSE, CSE(AI&DS))

Time: 3 hours

Max. Marks: 70

*Question Paper consists of FIVE units, each carrying 14 marks
Each unit has TWO questions; either of them should be answered
All parts of a question must be answered at one place*

- 1.a) (a) Construct truth tables for the following: (7M)
(i) $(p \vee q) \wedge r$ (ii) $(p \downarrow q) \wedge (p \downarrow r)$

- 1.b) Identify whether the following Inference is valid or Invalid. If Invalid, state the fallacy (7M)
- C V D
(C V D) \rightarrow \sim H
 \sim H \rightarrow (A \wedge \sim B)
(A \wedge \sim B) \rightarrow (R \vee S)

R V S

(OR)

- 1.c) Translate the given statements into propositional logic using the propositions provided: (7M)
P: "The message is scanned for viruses"
Q: "The message was sent from an unknown system"
i) "The message is scanned for viruses whenever the message was sent from an unknown system."
ii) "It is necessary to scan the message for viruses whenever it was sent from an unknown system."

- 1.d) Show that the following is inconsistent $P \rightarrow Q, R \rightarrow S, P \vee R, \sim (Q \vee S)$. (7M)

- 2.a) Find the number of equivalence relations that can be defined on a finite set A with $|A|=4$ (7M)
- 2.b) Prove that the transitive closure R^+ of a relation R on a set A is the smallest transitive relation on A containing R. (7M)

(OR)

- 2.c) Let $A=\{1, 2, 3, 4\}$ in which ordered pairs are in the relation. (7M)
 $R = \{(a, b) \mid a \text{ divides } b\}$. Outline its representation with ordered pairs
- 2.d) Explain properties of binary relations with examples. (7M)

- 3.a) Use characteristic roots method to solve the following recurrence relation $a_n - 7a_{n-1} + 16a_{n-2} - 12a_{n-3} = 0$ for $n \geq 3$ and $a_0=1, a_1=0$ and $a_2=8$ (7M)

- 3.b) Let f be function from $\{a,b,c,d\}$ to $\{1,2,3,4\}$ with $f(a) = 4, f(b) = 2, f(c) = 1$ and $f(d) = 3$. (7M)
Investigate whether f is one-one, Into and Onto function. Give reasons

(OR)

- 3.c) Determine whether the following functions are injective, surjective or bijective. Also describe the inverses of the bijective functions. (7M)

i) The function $f: N \rightarrow N$ with $f(a)=9$ and $f(n) = \begin{cases} 3f(n) + 1 & \text{if } f(n) \text{ is odd} \\ \frac{1}{2}f(n) & \text{if } f(n) \text{ is even} \end{cases}$

ii) A function $f: A \rightarrow A$ satisfying $f(f(x))=f(x)$ for all $x \in A$

3.d) In a lattice (L, \leq, \wedge, \vee) state and prove the laws idempotent, commutative, association and absorption. (7M)

4.a) If G is a group and H is a subgroup of index 2 in G , then prove that H is a normal subgroup of G . write in detail about subgroup (7M)

4.b) Find whether $(Z, +)$ and $(Z, *)$ satisfies Semi group or not where Z be the set of integers and addition, multiplication $(+, *)$ are binary operations. (7M)

(OR)

4.c) Let R denote the group of real numbers with addition and R^* denote the group of non-zero real numbers with multiplication. For $x \in R$, $|x|$ denotes the absolute value of x . For each part, determine whether the mapping given is a group homomorphism. Justify your answers briefly. (7M)

4.d) G is a group and there exists two relatively prime positive integers m and n such that $a^m b^m = b^m a^m$ and $a^n b^n = b^n a^n$ for all $a, b \in G$, prove that G is Abelian? (7M)

5.a) Use any method to solve the following recurrence relation (7M)
 $a_n - 9a_{n-1} + 26a_{n-2} - 24a_{n-3} = 0$ for $n \geq 3$ with the initial conditions
 $a_0 = 0, a_1 = 1, a_2 = 10.$

5.b) Solve the recurrence relation $a_{r+2} - 3a_{r+1} + 2a_r = 0$ (7M)
(OR)

5.c) Using generating functions method solve the following recurrence relation (7M)

$$a_n - 6a_{n-1} + 12a_{n-2} - 8a_{n-3} = 0 \text{ for } n \geq 3.$$

5.d) Find the 8th term of the sequence $\{a_n\}$ if a_n equals to (7M)

$$(i) 2n-1 \quad (ii) 1 + (-1)^n$$

Final copy as received.

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B. Gangwan
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CB. Gangwan Bhavoo