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RV COLLEGE OF ENGINEERING®

(An Autonomous Institution affiliated to VTU)

III Semester B. E. Fast Track Examinations Oct-2020

Computer Science and Engineering

DISCRETE MATHEMATICAL STRUCTURES

Time: 03 Hours ***Maximum Marks: 100***

Instructions to candidates:

1. Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
2. Answer FIVE full questions from Part B. In Part B question number 2, 7 and 8 are compulsory. Answer any one full question from 3 and 4 & one full question from 5 and 6

PART-A

1	1.1	How many even 4 digit whole numbers are there?	02
	1.2	________ bytes are required to encode 2000 bits of data.	01
	1.3	A function is said to be ________ if and only if $f(a) = f(b)$ implies that $a = b$ for all a and b in the domain of f.	
	1.4	A group $(M,*)$ is said to be abelian if ________ property holds in a group.	01
	1.5	The set of complex numbers $\{1, i, -i, -1\}$ under multiplication operation is a ___________ group.	01
	1.6	The number of words of 4 consonnats and 3 vowels can be made from 15 consonants and 5 vowels, if all the letters are different is ________.	02
	1.7	A head boy, two deputy head boys, a head girl and 3 deputy head girls must be chosen out of a student council consisting of 14 girls and 16 boys. In how many ways can they be chosen?	02
	1.8	There are 15 people in a committee. How many ways are there to group these 15 people into 3,5, and 4?	02
	1.9	Find the coefficient of x^8 in the expansion of $(x + 2)^{11}$.	02
	1.10	Write the type of the binary relation $\{(1,1), (2,1), (2,2), (2,3), (2,4), (3,1), (3,2)\}$ on the set $\{1,2,3\}$.	02
	1.11	For the given statement write converse and contra-positive. $"if\ 5x - 1 = 9, \text{then } x = 2"$	02
	1.12	Verify the given statement is tautology or not using truth table: a) $[(p \rightarrow q) \wedge p] \rightarrow p$ b) $(r \rightarrow s) \leftrightarrow (s \rightarrow r)$	02

PART-B

2	a	How many solutions are there to equation $x1 + x2 + x3 + x4 + x5 + x6 = 29$, where $x1, x2, x3, x4, x5, x6$ are non negative integers such that $x1 \leq 5$.	06
	b	Using mathematical induction show that : $[3\ divides\ (n^3 + 2n)], \forall n \epsilon N$.	04
	c	The Fibonacci sequence $F_0, F_1, F_2, \ldots\ldots\ldots$ Satisfies the recurrence relation $F_k = F_{k-1} + F_{k-2}$ for all integers $k \geq 2$ with initial conditions $F_0 = F_1 = 1$. Find an explicit formula for this sequence.	06

3	a	Convert the following sentences to quantified statements using Universal quantifiers only. Assume Domain D contains only humans. i) No one who runs walks ii) If anyone cheats, he suffers. iii) If anyone cheats, everyone suffers.	06
	b	Consider the following hypotheses: “It is not sunny this afternoon and it is colder than yesterday”. “We will go swimming only is it is sunny”. “If we do not go swimming, then we will take a canoe trip”. “If we take a canoe trip, then we will be home by sunset”. Using the interference rules, prove that the following given conclusion is valid: “We will be home by sunset”.	06
	c	Write each of these statements in the form “if p, then q” in English. i) It snows whenever the wind blows from the northeast ii) It is necessary to walk 8 miles to get to the top of Long’s Peak. iii) To get tenure as a professor, it is sufficient to be world-famous. iv) You can access the website only if you pay a subscription fee.	04
		OR	
4	a	Apply rules of inference to prove the following argument is valid for the quantified premises. *A student in this class has not read the book.* <u>*Everyone in this class passed the first exam.*</u> $\therefore$ *Someone who passed the first exam has not read the book.*	06
	b	Using laws of logic prove the following: i) $[p \wedge (\neg r \vee q \vee \neg q)] \vee [r \vee t \vee \neg r) \wedge \neg q] \Leftrightarrow p \vee \neg q$ ii) $(p \wedge \neg q) \vee (\neg p \wedge q) \Leftrightarrow \neg(p \leftrightarrow q)$ iii) $(p \rightarrow q) \wedge (p \rightarrow \neg q) \Leftrightarrow \neg p$	06
	c	Let p, q, and r be the propositions p: *You get an A on the final exam* q: *You do every exercise in this book.* r: *You get an A in this class.* write these propositions using p, q and r and logical connectives. i) You get an A on the final, but you don’t do every exercise in this book; nevertheless, you get an A in this class. ii) Getting an A on the final and doing every exercise in this book is sufficient for getting an A in this class. iii) You will get an A in this class if and only if you either do every exercise in this book or you get an A on the final. iv) To get an A in this class, it is necessary for you to get an A on the final.	04
5	a	Let $A = \{a, b, c, d, e\}$ and $B = \{1,2,3,4,5,6,7,8\}$ i) Determine the number of functions from A to B. How many of them are one to one and onto. ii) Determine the number of functions from B to A. How many of them are one to one and onto.	04
	b	Let f and g be functions from $R \rightarrow R$ defined by $f(x) = ax + b$ and $g(x) = cx + d$. What relationship must be satisfied by $a, b, c\, d$ if $g \circ f = f \circ g$	06
	c	Let $A = \{1,2,3,4,5, \dots \dots \dots \dots 18, 19, 20\}$ and R be the equivalence relation on A defined by aRb if and only if $a - b$ is divisible by 5. Find the partition of A induced by R.	06

		OR	
6	a	Consider A as finite set of 'n' elements then determine the following: i) Number of Anti-symmetric relations. ii) Number of reflexive and symmetric relations	06
	b	Consider the poset $A = \{2,3,4,6,18,24\}$ with the divisibility relation defined on it. i) Draw its Hasse diagram. ii) Find its maximal, minimal, greatest and least elements. iii) Find upper bounds, GLB, LUB and lower bounds for the subset $M = \{2,3,6\}$.	06
	c	Explain about different types of functions with neat diagram.	04
7	a	Define the following terms: i) $\in -$closure of a state ii) Extended transition function δ *for $\epsilon - NFA$. iii) NFA and its language. iv) Extended transition function δ *for DFA.	08
	b	Design a deterministic and non-deterministic finite automate with transition table which accept 00 and 11 ath the end of a string over the alphabet set $\sum(0,1)$.	08
8	a	Prove that $(Z_{5,}^{*} *)$ is a cyclic group. Find all its generators.	04
	b	If $\circ$ is an operation on set of integers Z defined by $x \circ y = x + y + 1$, Prove that $(Z,\circ)$ is a group.	06
	c	The generator matrix for an encoding function $E: Z_2^2 \rightarrow Z_2^5$ is given by $G = \begin{bmatrix} 1 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 & 1 \end{bmatrix}$ i) Determine all the code words ii) obtain the associated parity check matrix.	06