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RV COLLEGE OF ENGINEERING®

(An Autonomous Institution affiliated to VTU)

III Semester B. E. Examinations Nov/Dec-19

Computer Science and Engineering

DISCRETE MATHEMATICS

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

Instructions to candidates:

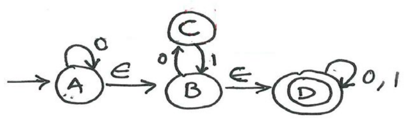
1. Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
2. Answer FIVE full questions from Part B. In Part B question number 2, 7 and 8 are compulsory. Answer any one full question from 3 and 4 & one full question from 5 and 6

PART-A

1	1.1	Verify the function $f(a,b) = \lvert b \rvert, f: Z \times Z \rightarrow Z$ is onto or not.	01
	1.2	In a playground 3 sisters and 8 other girls are playing together. In a particular game, how many ways can all the girls be seated in a circular order so that the three sisters are not seated together?	02
	1.3	How many even 5 digit whole numbers are there (with repetitions)?	01
	1.4	On the plane there are 6 different points (no 3 of them are lying on the same line). How many segments do you get by joining all the points?	01
	1.5	There are 15 people in a committee. How many ways are there to group these 15 people into 3,5 and 4?	01
	1.6	Find the coefficient of x^8 in the expansion of $(x+2)^{11}$.	01
	1.7	Determine the sets A and B, given that $A - B = \{1,3,7,11\}, B - A = \{2,6,8\}$ and $A \cap B = \{4,9\}$.	02
	1.8	If a_n is a solution of the recurrence relation $a_{n+1} = ka_n$ for $n \geq 0$ and $a_3 = 153/49$ and $a_5 = 1377/2401$. What is k?	02
	1.9	Let f and g be the function from the set of integers to itself, defined by $f(x) = 2x + 1$ and $g(x) = 3x + 4$. Then the $f \circ g$ is _________.	01
	1.10	Find the generators of the group $(Z_6, +)$.	02
	1.11	The word $c = 1010110$ is transmitted through a binary symmetric channel. If $e = 0101101$ is the error pattern, find the word r received.	02
	1.12	Construct a DFA that never recognizes two consecutive $b's$ in the alphabet set $\{a, b\}$.	02
	1.13	The inverse of function $f(x) = x^3 + 2$ is _________.	01
	1.14	_________ number of reflexive relations are there on a set of 11 distinct elements.	01

PART-B

2	a	A survey of 500 television viewers of a sports channel produced the following information: 285 watch cricket, 195 watch hockey, 11 watch football, 45 watch cricket and football, 70 watch cricket and hockey, 50 watch hockey and football and 50 do not watch any of the three games. i) How many viewers in the survey watch all three kinds of games? ii) How many viewers watch exactly one of the sports?	06

	b c	For which x positive integer stands: $C(x-1, x+1) <= 21$ At a dinner party 6 men and 6 women sit at a round table. In how many ways can they sit if: i) There are no restrictions, ii) Bob, Ted and Carol must sit together, iii) Neither Bob nor Carol can sit next to Ted.	04 06
3	a b c	State the converse, contrapositive, and inverse for each of the given conditional statement: i) I come to class whenever there is going to be quiz. ii) Getting elected follows from knowing the right people. Determine whether the following argument is valid using quantifiers. No Engineering student of first or Second Semester studies logic. Anil is an Engineering student who studies Logic. ∴ Anil is not in Second semester. 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 in this class, but you don't do every exercise in this book, ii) 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, iii) Getting an A on the final and doing every exercise in this book is sufficient for getting an A in this class, iv) 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. **OR**	 04 06 06
4	a b c	Solve the recurrence relation $a_n = -3a_{n-1} - 3a_{n-2} - a_{n-3}$ with $a_0 = 1, a_1 = -2$ and $a_2 = -1$. Prove that $4n < (n^2 - 7)$ for all positive integers $n \geq 6$. Solve the recurrence relation $a_n = a_{n-1} + 2a_{n-2}$ with $a_0 = 2, a_1 = 7$.	 06 06 04
5	a b	Construct a DFA and NFA that accepts a string of the form $(a\|b)^*abb$ over the alphabet $\{a, b\}$. Define the following terms: i) Language accepted by NFA, ii) Extended transition function for NFA, iii) DFA and its Language, iv) ϵ-closure of a state. **OR**	 08 08
6	a b	Construct DFA accepting the following language over the alphabet $\{a, b\}$: i) L = the set of all strings starting and ending with different symbol. ii) $L = \{a^n b^m c^l \| n, m, l \geq 1\}$. Convert the given ϵ-NFA to DFA. (convert ϵ-NFA to NFA and then NFA to DFA). 	 08 08

7	a	Consider the poset $A = \{2,3,4,5,6,30,60\}$ with the divisibility relation defined to it: i) Draw its Hasse diagram, ii) Find its maximal, minimal, greatest and least elements if they exist, iii) Find upper bounds, lower bounds, GLB and LUB for the subset $M = \{4,6\}$.	06
	b	Consider the sets $A = \{a, b, c\}$ and $B = \{1,2,3\}$ and the relations, $R = \{(a, 1), (b, 1), (c, 2), (c, 3)\}$ and $S = \{(a, 1), (a, 2), (b, 1), (b, 2)\}$ from A to B. Consider the set $C = \{x, y, z\}$ and a relation $R_2 = \{(1, x), (1, y), (3, z)\}$ from B to C. Determine $\bar{R}$ (R complement), $R \cup S$, $R \cap S$, R^C(R converse) and $R \circ R_2$.	04
	c	Consider the function $f: R \to R$ defined by $f(x) = 2x + 5$. Let $g: R \to R$ be a function defined by $g(x) = \frac{1}{2}(x - 5)$. Prove that functions g and f are invertible functions.	06
8	a	State and Prove Lagrange's theorem.	05
	b	Let f be a homomorphism from a group G_1 to a group G_2. Then prove the following: i) If e_1 is identity element in G_1 and e_2 is the identity element of G_2 then prove $(e_1) = e_2$. ii) $f(a^{-1}) = \left(f(a)\right)^{-1}$ for all $a \epsilon G_1$.	05
	c	The generator matrix for an encoding function $E: Z_2^3 \to Z_2^6$ is given by: $G = \begin{bmatrix} 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 & 1 \end{bmatrix}$ i) Find the code word assigned to 010 and 110, ii) Obtain the associated parity check matrix, iii) Decode the received word: 110110,111101.	06