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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Third Semester, B.E. - Computer Science and Engineering

Semester End Examination; March / April - 2022

Discrete Mathematical Structures

Time: 3 hrs *Max. Marks: 100*

Course Outcomes

The Students will be able to:

CO1: Verify the correctness of an argument using propositional and predicate logic.

CO2: Demonstrate the ability to solve problems using counting techniques and Combinatorics in the context of discrete probability.

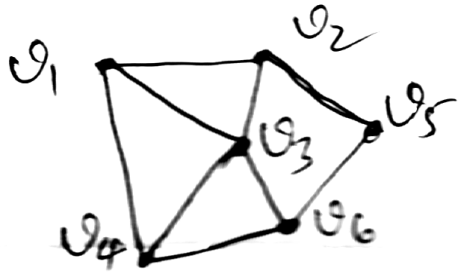
CO3: Solve problems involving recurrence relations.

CO4: Construct proofs using direct proof, proof by contraposition, proof by contradiction, and proof by cases, and mathematical induction.

CO5: Ability to Explain and distinguish graphs and their properties.

***Note**: I) **PART - A** is compulsory. **Two** marks for each question.*

*II) **PART - B**: Answer any **Two** sub questions (from a, b, c) for a Maximum of **18 marks** from each unit.*

Q. No.	Questions	Marks	BLs	COs	POs
	I : PART - A	**10**			
I a.	p : A is a circle or a conic q : $\sqrt{5}$ is a real number r: Exponential series is convergent. Express the compound proportion $p \rightarrow (q \vee r)$ in words.	2	L2	CO1	PO1
b.	Obtain the recursive definition for the sequence (a_n) given by, $a_n = n\,(n+2)$.	2	L1	CO2	PO1
c.	Let $f : R \rightarrow R$ defined by, $f(x) = \begin{cases} 3x-5 & x>0 \\ -3x+1 & x \le 0 \end{cases}$ Determine: $f^{-1}(0)$, $f^{-1}(1)$.	2	L2	CO3	PO1
d.	There are eight letters to eight different people to be placed in different addressed envelopes. Find the number of ways of doing this so that at least one letter gets to the right person.	2	L2	CO4	PO1
e.	Determine the number of different paths of length 2 in the graph shown below. 	2	L2	CO5	PO2

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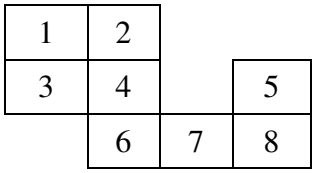
	II : PART - B	**90**			
	UNIT - I	**18**			
1 a.	Prove that for any three propositions, $\neg\left[\{(p \vee q) \wedge r\} \rightarrow \neg q\right] \Leftrightarrow \neg\left[\neg\{(p \vee q) \wedge r\} \vee \neg q\right] \Leftrightarrow q \wedge r.$	9	L2	CO1	PO2
b.	Establish the validity of the argument, $p \rightarrow q$ $q \rightarrow r \wedge s$ $\neg r \vee (\neg t \vee u)$ $p \wedge t$ $\therefore u$	9	L3	CO1	PO2
c.	Find whether the following argument is valid? If a triangle has two equal sides then it is isosceles If a triangle is isosceles. Then it has two equal angles The triangle ABC does not have two equal angles. $\therefore$ ABC does not have two equal sides.	9	L2	CO1	PO2
	UNIT - II	**18**			
2 a.	If n is any positive integer prove that, $1.2+2.3+3.4+\cdots+n(n+1)=\frac{1}{3}n(n+1)(n+2)$ using mathematical induction.	9	L1	CO2	PO1
b.	A sequence $\{a_n\}$ is defined recursively by, $a_1 = 4,\ a_n = a_{n-1} + n,\ n \geq 2$ find a_n in explicit form.	9	L2	CO2	PO1
c.	I) How many arrangements are there for all letters in the word SOCIOLOGICAL? II) In how many of these arrangements? i) A and G are adjacent? ii) All the vowels are adjacent?	9	L2	CO2	PO2
	UNIT - III	**18**			
3 a.	State Pigeon hole principle and extended Pigeon hole principle. A magnetic tape contains a collection of 5 lakh strings made up of four or fewer number of english letters. Can all the strings in the collection be distinct?	9	L3	CO3	PO2
b.	Let $A = \{1, 2, 3, 4, 5\}$. Define a relation R on A X A by, $(x_1, y_1)\ R\ (x_2, y_2)$ If and only if $x_1 + y_1 = x_2 + y_2$ i) Verify that R is an equivalence relation on $A \times A$ ii) Determine the equivalence classes $[(1,3)]$, $[(2,4)]$ and $[(1,1)]$ iii) Determine the partition of $A \times A$ induced by R.	9	L2	CO3	PO2

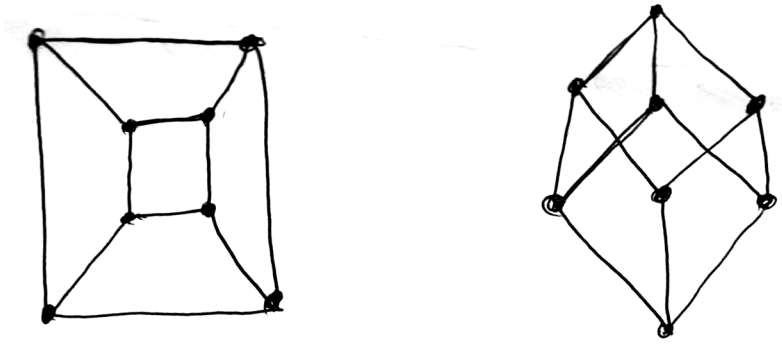
Contd... 3

c.	Let $S=\{1,2,3\}$ and $P(S)$ be the power set of S on $P(S)$. Define the relation R by $X\ R\ Y$ if and only if $X \subseteq Y$. Show that this relation is a partial order on $P(S)$. Draw its Hasse diagram.	9	L2	CO3	PO1

UNIT - IV **18**

4 a.	Find the rook polynomial for the board shown below  	9	L3	CO4	PO2
b.	Solve the recurrence relation $a_n - 3a_{n-1} = 5\times 3^n$ for $n \geq 1$ given that $a_0 = 2$.	9	L2	CO4	PO2
c.	How many integers between 1 and 300 (inclusive) are, i) Divisible by at least one of 5, 6, 8? ii) Divisible by none of 5, 6, 8?	9	L2	CO4	PO2

UNIT - V **18**

5 a.	Show that the following two graphs are isomorphic 	9	L2	CO5	PO1
b.	Explain the Konigsberg bridge problem related to graph theory.	9	L2	CO5	PO2
c.	Obtain an optimal prefix code for the message, "LETTER RECEIVED". Indicate the code.	9	L3	CO5	PO2

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