U.S.N

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

(An Autonomous Institution affiliated to VTU, Belagavi)

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

Make-up Examination; May - 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.	Write the converse, contrapositive of the statement, "If you have password then you can log in to your account".	2	L2	CO1	PO1
b.	Represent the given sequence recursively and explicitly, 3, 1, 3, 1, 3, 1, ……..	2	L2	CO2	PO2
c.	Represent in the symbolic form and negate, "Some integers are divisible by 5".	2	L2	CO3	PO2
d.	Define derangements and list all derangements of 1, 2, 3, 4.	2	L2	CO4	PO1
e.	Define an r-regular graph. Does a graph 3-regular of 19 vertices exist (Justify).	2	L3	CO5	PO1
	II : PART - B	**90**			
	UNIT - I	**18**			
1 a.	Define Tautology, Logical equivalence. Simplify $(\neg p \vee \neg q) \rightarrow (p \wedge q \wedge r)$ using laws and without laws.	9	L2	CO1	PO2
b.	Verify the validity of the given argument, $P \rightarrow (q \rightarrow r)$ $P \vee \neg s$ $\underline{q \qquad\qquad}$ $\therefore s \rightarrow r$	9	L3	CO1	PO2
c.	Define Quantifiers with an example for each. Find the truth value of the following statements: (i) $\forall x p(x) \rightarrow q(x)$ (ii) $\neg x p(r) \wedge q(x)$ (iii) $\forall x \neg p(x) \rightarrow \neg q(x)$ Where; $p(x): x^2 = x$; $q(x): x$ is even.	9	L3	CO1	PO3

Contd… 2

UNIT - II 18

2 a. (i) Prove that $1^3+2^3+3^3+......+n^3=\left[\frac{n(n+1)}{2}\right]^2 \quad \forall\, n\geq 1$.

(ii) Disprove $\sum_{i=1}^{n} i=\frac{n^2+n+2}{2}$. — 9 L2 CO2 PO2

b. Define Binomial and Multinomial theorem and hence find the coefficient of $x^6y^7z^3$ in the expansion of $(2x+3y-z+7)^{20}$. — 9 L2 CO2 PO4

c. Find the number of positive integer solutions of the equations,

(i) $x_1+x_2+x_3+x_4+x_5<20$ for all $x_i\geq 1$

(ii) $x_1+x_2+x_3+x_4+x_5=20 \;\forall\; x_i\geq 0$ — 9 L3 CO2 PO4

UNIT - III 18

3 a. Let "R" be a relation defined as $(a,b)\in R$ iff $a\equiv b(\text{mod}\,3)$ on A = {3, 4, 6, 7, 8}

(i) Prove that "R" is an equivalence relation

(ii) Write the matrix relation of R

(iii) Draw the Digraph representing the relation

(iv) Find the Partition induced by R on A — 9 L2 CO3 PO2

b. Find the number of equivalence relations that can be defined on a finite set A, $|A|=5$. — 9 L2 CO3 PO2

c. Let A = {1, 3, 6, 18, 12} and "R" be a relation defined as $(a,b)\in R$ iff "a is multiple of b". Prove that R is a partially ordered relation and draw the Hasse's diagram that represents the relation. — 9 L2 CO3 PO1

UNIT - IV 18

4 a. Determine the number of integers 1 to 300 (inclusively) which are divisible by,

(i) exactly two of 5, 6, 8

(ii) at least two of 5, 6, 8 — 9 L2 CO4 PO1

b. Define derangements.

(i) Derive the formula for $d_n=n!\sum_{k=0}^{n}\frac{(-1)^k}{k!}$.

(ii) Find the rook polynomial for 3 x 3 board. — 9 L2 CO4 PO2

c. Solve the recurrence relation,

$2a_{n+3}=a_{n+2}+2a_{n+1}-a_n$ for $n\geq 0$ with $a_0=0$, $a_1=1$, $a_2=2$. — 9 L2 CO4 PO2

Contd... 3

UNIT - V **18**

5 a. (I) Define Euler graph and Hamiltonian graphs.

(II)Determine the order $|V|$ of the graph $G = (V, E)$ in the following cases

(i) G is a cubic graph with 9 edges

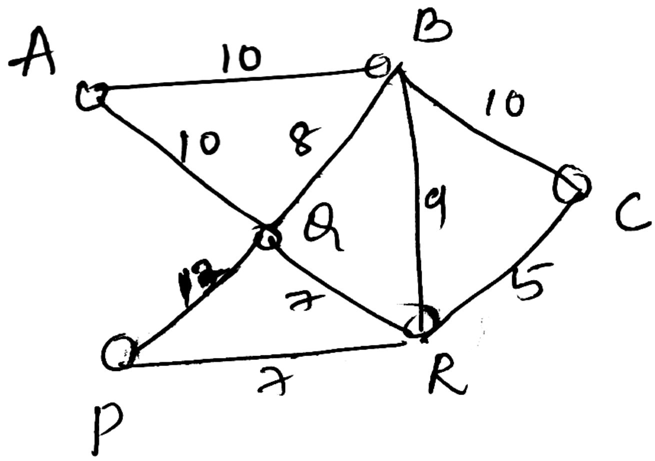
(ii) G is a regular with 15 edges

(iii) G has 10 edges with 2 vertices of degree 4 and all the vertices of degree 3

9 L3 CO5 PO4

b. Define optimal prefix code and find the same for the message "LETTER RECEIVED". Indicate the code. 9 L3 CO5 PO4

c. Using Kruskal's algorithm and Prim's Algorithm to find the minimal spanning tree of the graph given below: 9 L3 CO5 PO4



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