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

(An Autonomous Institution affiliated to VTU, Belagavi)

First Semester, Master of Computer Applications (MCA)

Semester End Examination; June - 2022

Mathematical Foundation for Computer Applications

Time: 3 hrs *Max. Marks: 100*

Course Outcomes

The Students will be able to:

CO1: Explain the principles of counting and set theory.

CO2: Identify the quantifiers and their uses and Make use of fundamentals of logic theory.

CO3: Apply the mathematical induction principle and different methods to solve the given problems.

CO4: Solve the problems using the concepts of relations and functions and identify the different ways of representing relations.

CO5: make use of basic concepts of graph theory and solve the given problem.

Note: I) *Answer any* ***FIVE*** *full questions, selecting* ***ONE*** *full question from each unit.*

II) *Any* ***THREE*** *units will have internal choice and remaining* ***TWO*** *unit questions are compulsory.*

III) *Each unit carries 20 marks.*

Q. No.	Questions	Marks	BLs	COs	POs
	UNIT - I				
1 a.	In how many ways can six men and six women be seated in a row? i) If any person may sit next to any other? ii) If men and women must occupy alternate seats?	6	L3	CO1	PO2
b.	A certain question paper contains three parts A, B, C with four questions in *part A* , five questions in *part B* and six questions in *part C*. It is required to answer seven questions selecting atleast two questions from each part. In how many different ways can a student select his seven questions for answering?	7	L3	CO1	PO1
c.	A total amount of Rs.1500 is to be distributed to 3 poor students A, B, C of a class. In how many ways the distribution can be made in multiples of Rs. 100? i) If everyone on these must get atleast Rs.300? ii) If A must get atleast Rs.500 and B and C must get atleast Rs.400 each?	7	L3	CO1	PO1
	OR				
1 d.	If $U=\{1,2,3,4,5,6,7,8,9\}$, $A=\{1,2,3,5,7\}$ $B=\{2,5\}$ $C=\{2,3,7\}$. Evaluate the following: *i)* $A\cap(B-C)=(A\cap B)-C$ *ii)* $(A-B)\cap(A-C)=A-(B\cup C)$	6	L5	CO1	PO2
e.	A professor has two dozen text books on computer science and is concerned about their coverage of topics; ***A***-Compilers, ***B***-Data structures and ***C***-operating systems. The following are the numbers of books that contain material on these topics:	7	L1	CO1	PO1

Contd… 2

$|A|=8,\ |B|=13,\ |C|=13,\ |A\cap B|=5,\ |A\cap C|=3,\ |B\cap C|=6,\ |A\cap B\cap C|=2$

i) How many of the textbooks include material on exactly one of these topics?

ii) How many do not deal with any of the topics?

f. Prove that $|\overline{A\Delta B}| = A\,\Delta\,\overline{B} = \overline{A}\,\Delta\,B,$ by membership table method. 7 L5 CO1 PO1

UNIT - II

2 a. Check whether $[(p\rightarrow q)\wedge(p\rightarrow\neg q)]\leftrightarrow\neg p$ is a tautology using truth table. **7** L2 CO2 PO1

b. i) State the rule of syllogism

ii) Test whether the following is a valid argument

If *I* study, then if do not fail in the examination

If *I* do not fail in the examination my father gifts a two wheeler to me.

Therefore, if I study then my father gifts a two wheeler to me. 6 L3 CO2 PO1

c. For the universe of all integers let, $P(x)$: $x>0$, $Q(x)$: x is even $R(x)$: x is a perfect square and $S(x)$: x is divisible by 3.

Write down the following statement in symbolic form and also write their negations: 7 L2 CO2 PO1

i) Atleast one integer is even

ii) If x is even and a perfect square, then x is not divisible by 3

iii) There exists a positive integer which is even

UNIT - III

3 a. Prove that $4n<(n^2-7)$ for all positive integers n ≥ 6. 7 L2 CO3 PO1

b. For any non empty sets A,B,C prove that;

i) $AX(B\cup C)=(AXB)\cup(AXC)$

ii) $AX(B-C)=(AXB)-(AXC)$ 6 L2 CO3 PO1

c. If $A=\{1,2,3\}$ $B=\{2,4,5\}$ and R is a relation from A to B defined by, $(a,b)\in R$. Iff b is a multiple of a. Compute;

i) AXB *ii*) $|AXB|$

iii) Number of relations from A to B also writes R as a set of ordered pairs 7 L2 CO3 PO2

OR

3 d. Let $A=\{1,2,3,4\}$ *and* $B=\{1,2,3,4,5,6\}$

i) How many functions are there from A to B which is one-one?

ii) How many onto functions are there from B to A?

iii) Can we have any onto functions from A to B? 6 L1,2 CO3 PO1

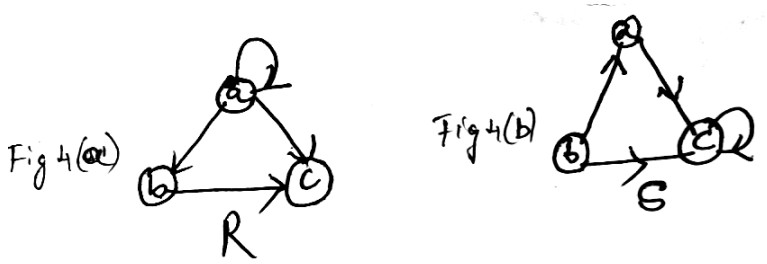
Contd… 3

e. State pigeon hole principle. Prove that, if 30 dictionaries in a library contain a total of 61,327 pages, then atleast one of dictionaries must have at least 2045 pages. 7 L3 CO3 PO2

f. If *f* and *g* are any two functions from *R*-to-*R* defined by, $f(x) = x^2$ *and* $g(x) = x + 5$. Compute *fog*, *gof*, *fof*, *gog*. 7 L2 CO3 PO2

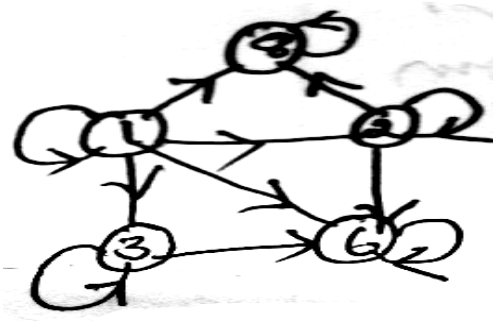
UNIT - IV

4 a. The digraphs of two relations *R* and *S* on $A = \{a, b, c\}$ are given below. Find $\overline{R}, R \cup S, R \cap S$ and their matrices. 6 L2 CO4 PO1



b. On the set of all integers Z, the relation R is defined by, $(a,b) \in R$ *iff* $a^2 - b^2$ *is an* even integer. Show that *R* is an equivalence relation 7 L2 CO4 PO1

c. The digraph for a relation on the set $A = \{1, 2, 3, 6, 8\}$ is as shown below;

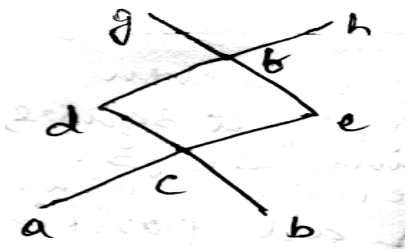


7 L2 CO4 PO2

Verify that (A, R) is a Poset. Also draw its Hasse diagram.

OR

4 d. Consider the Hasse diagram of a poset (A,R) given



6 L1 CO4 PO2

If $B = \{c, d, e\}$ find

i) All upper bounds of B ii) All lower bounds of B

iii) The LUB of B iv) The GLB of B

Contd… 4

e.	Define least element, greatest element, minimal element maximal element of a relation R on A.	7	L1	CO4	PO1
f.	Define partially ordered set and draw the Hasse diagram of all positive divisors of 36.	7	L1	CO4	PO1

UNIT - V

5 a.	Define the following with an example for each: i) Complete graph ii) Bipartite graph iii) Regular graph	6	L1,2	CO5	PO2
b.	Give examples of graphs which are; i) Eulerian and Hamiltonian ii) Eulerian but not Hamiltonian iii) Hamiltonian but not Eulerian iv) Neither Eulerian nor Hamiltonian	7	L2	CO5	PO2
c.	Discuss Konigsberg Bridge problem.	7	L6	CO5	PO2

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