



Maximum Marks: 100	Semester: July 2023 - October 2023	Duration: 3 Hrs.
Programme code: 01	Examination: ESE Examination	
Programme: BTech in Computer Engineering	Class: SY	Semester: III (SVU 2020)
Name of the Constituent College: K. J. Somaiya College of Engineering	Name of the department: Computer Engineering	
Course Code: 116U01C305	Name of the Course: Discrete Mathematics	
Instructions: 1) Draw neat diagrams 2) All questions are compulsory 3) Assume suitable data wherever necessary		

Que. No.	Question	Max. Marks
Q1 i)	Solve any Four Show that if every element in a group is its own inverse, then the group must be abelian.	20
ii)	"If the labour market is perfect then the wages of all persons in a particular employment will be equal. But it is always the case that wages for such persons are not equal therefore the labour market is not perfect". Test the validity of the argument.	5
iii)	Using the laws of logic, prove that: $\sim(p \wedge q) \rightarrow (\sim p \vee (\sim p \vee q)) \equiv \sim p \vee q$	5
iv)	Define following with an example: i. Power Set ii. Partition of a set.	5
v)	If $f : \{R - (2/5)\} \rightarrow \{R - (4/5)\}$ is function defined by $f(x) = \frac{4x+3}{5x-2}$, prove that f is a bijection and find f^{-1}	5
vi)	Define the following terms with example: (i) Eulerian graph (ii) Hamiltonian graph	5

Que. No.	Question	Max. Marks
Q2 A	Solve the following	
i)	Among 50 students in a class, 26 got A in the first examination and 21 got A in second examination. If 17 students did not get an A in either examination, how many students got A in both examinations.	10
ii)	Use Mathematical Induction to prove that $7^n - 1$ is divisible by 6 for $n = 1, 2, 3, \dots$	5
Q2 A	OR	
	Let $S = \{1, 2, 3\} \times \{1, 2, 3, 4\}$ and let a relation R on S be defined as $(x, y)R(u, v)$ if $ x - y = u - v $. Compute the partition associated with the equivalence relation R	10
Q2 B	Solve any One	
i)	Let $B = \{b_1, b_2, b_3, b_4, b_5\}$ and let R be the relation given by the following matrix	10

$$R = \begin{bmatrix} 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 \\ 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix}$$

Find transitive closure of R.

- ii) For the set $X = \{2, 3, 6, 12, 24, 36\}$, a relation \leq is defined by $x \leq y$ if x divides y . Draw Hasse diagram for (X, \leq) . Answer the following:
- What are maximal and minimal elements?
 - Give one example of chain and antichain.
 - Is the Poset a Lattice?

10

Que. No.	Question	Max. Marks
Q3	<p>Solve any Two</p> <p>Define Graph Isomorphism. Find whether following graphs are isomorphic or not. Justify your answer.</p>	20
ii)	<p>a) Is there a Hamiltonian circuit in a complete bipartite graph $K_{4,4}$ and $K_{4,6}$?</p> <p>b) Is there a Hamiltonian circuit in the graph shown in the Fig? What about a Hamiltonian path?</p>	10
iii)	<p>Determine whether Eulerian Path and Eulerian circuit exist in the graphs G_1 and G_2 shown in Fig below:</p>	10

Que. No.	Question	Max. Marks
Q4 i)	Solve any Two Consider the set $A = \{1, 2, 3, 4, 5, 6\}$ under multiplication modulo 7. a. Find multiplication table for above. b. Find the inverse of 2,3 and 5,6 c. Prove that it is a cyclic group. d. Find the orders and subgroups generated by {3,4} and {2,3}	20 10
ii)	Show that the (3,6) encoding function $e: B^3 \rightarrow B^6$ defined by $\begin{aligned} e(000) &= 000000 \\ e(001) &= 000110 \\ e(010) &= 010010 \\ e(011) &= 010100 \\ e(100) &= 100101 \\ e(101) &= 100011 \\ e(110) &= 110111 \\ e(111) &= 110001 \end{aligned}$	10
iii)	is a group code. Let $H = \begin{bmatrix} 1 & 0 & 0 \\ 1 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ is parity check matrix. Decode following words relative to a maximum likelihood decoding function e_{II} i. 011001 ii. 101001	10
Que. No.	Question	Max. Marks
Q5 i)	(Write notes / Short question type) on any four Let $f: R \rightarrow R, f(x) = x^2 - 1, g(x) = 4x^2 + 2$ find i. $fo(gof)$ ii. $go(fog)$	20 5
ii)	Show that there must be atleast 90 ways to choose six numbers from 1 to 15. So that all the choices have the same sum.	5
iii)	Show that the number of edges in a complete graph K_n is $n(n-1)/2$.	5
iv)	Determine the number of edges in a graph with 6 nodes, 2 of degree 4 and 4 of degree 2. Draw two such graphs.	5
v)	Let $X = \{1, 2, \dots, 7\}$ and $R = \{(x, y) x - y \text{ is divisible by } 3\}$. Show that R is equivalence relation. Draw graph of R .	5
vi)	Show that set $G = \{a + \sqrt{2} \cdot b; a, b \in Q\}$ is a group with respect to addition. Q is set of all rational numbers.	5