

**S. V. National Institute of Technology, Surat – 395007**  
**End Semester Examination, Dec – 2020**  
**B. Tech. II CSE Semester-III**  
**Discrete Mathematics (MA221)**  
**(Mathematics-III)**

**Date: 07-12-2020**

**Time: 03:30pm to 05:30pm (including uploading answer sheets)**

**Total Marks: [30]**

**Section II**

**General Instructions**

- (i) Figure to the right indicates marks.
- (ii) Each question carry same mark.
- (iii) Follow usual notations.

**Important Instructions**

1. On First page write your **Name, Contact No., Admission no., Subject Code and Subject Name, Total No. of pages, Signature.**
2. Every student must **sign and write their Admission number on the TOP OF EVERY ANSWERSHEET.**
3. Students must upload their answer sheets (**single pdf named as admission no.**) on Microsoft Team latest by **5.30pm on same day.**

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Solve any **Six:**

**[6X5=30]**

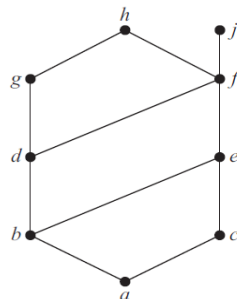
**Q.1**

(i) Why is  $f$  not a function from  $\mathbb{R}$  to  $\mathbb{R}$  if  $f(x) = \frac{1}{x}$  ? **[2]**

(ii) What are invertible functions? Let  $f$  be a function from  $\mathbb{R}$  to  $\mathbb{R}$  defined as  $f(x) = x^2$ . Is it invertible? **[3]**

**Q.2**

(i) Find the lower and upper bounds of the subsets  $\{a, b, c\}$ ,  $\{j, h\}$  and  $\{a, c, d, f\}$ . Find the greatest lower bound and least upper bound of  $\{b, d, g\}$ , if they exist, in the poset shown in following figure. **[2]**

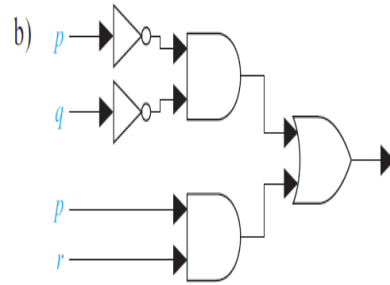
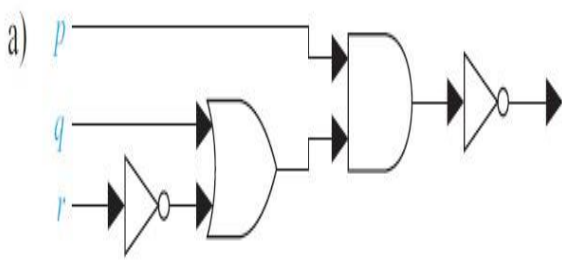


(ii) Give a description of each of the congruence classes modulo 6. **[3]**

**Q.3** Find the output of each of these combinatorial circuits

(i)

[2]



(ii) Translate each of these statements into logical expressions using predicates, quantifiers, and logical connectives.

[3]

- No one is perfect.
- Not everyone is perfect.
- All your friends are perfect.

**Q.4** (i) What is the minimum number of students required in a discrete mathematics class to be sure that at least six will receive the same grade, if there are five possible grades, A, B, C, D, and F?

[2]

(ii) A coin is flipped 10 times where each flip comes up either heads or tails. How many possible outcomes

- are there in total?
- contain exactly two heads?
- contain at most three tails?

[3]

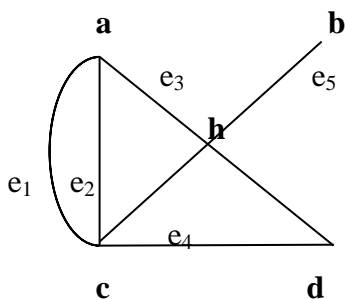
**Q.5** (i) Let  $H$  be a subgroup of a group  $G$  and  $x^2 \in H$ , for all  $x \in G$ . Show that  $H$  is normal in  $G$ .

[3]

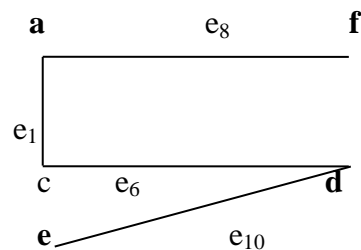
(ii) Let  $G = \{1, -1, i, -i\}$  be a group under multiplication and  $\bar{Z}_8 = \{1, 3, 5, 7\}$  a group under multiplication modulo 8. Show that  $G$  and  $\bar{Z}_8$  are not isomorphic.

[2]

**Q.6** Find the Union, Intersection, Ring sum graph  $G_1$  and  $G_2$ . Also, short-circuit vertex  $c$  &  $d$  in both graphs. Also draw the new graph for each, which is made by these operations.



Graph:  $G_1$



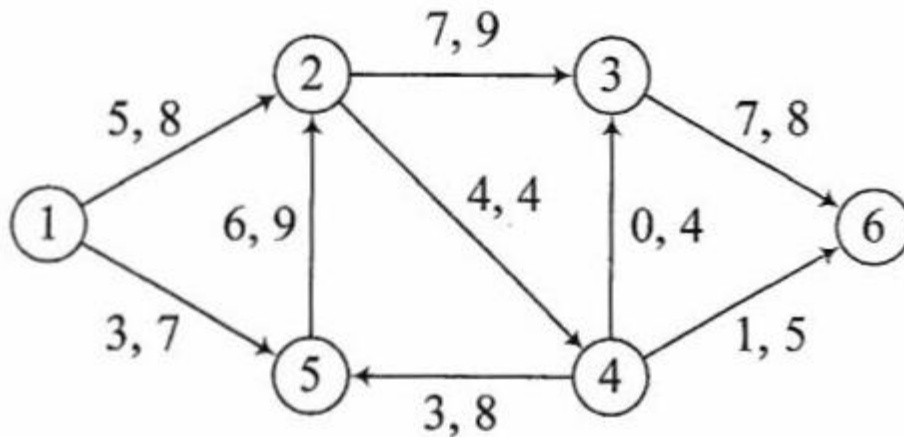
Graph:  $G_2$

[5]

**Q.7** (i) State the invariant conditions for graph isomorphism. With example explain that these are not sufficient condition for graphs to be isomorphic. [3]

(ii) Prove that a simple graph with  $n$  vertices must be connected if it has more than  $\frac{(n-1)(n-2)}{2}$  edges. [2]

**Q.8** (i) Define source and sink in capacitated network. Is the flow feasible in the capacitated network given below? Maximise the flow if it is not maximum flow.



(ii) Draw a graph which is Eulerian but not Hamiltonian and vice versa [2]