III SEMESTER B.TECH. FINAL EXAMINATIONS JULY 2021

SUBJECT: ENGINEERING MATHEMATICS [MAT 2155]

Date of Exam: **28-7-2021** Time of Exam: **9.00 AM – 12.00 PM** Max. Marks: **40**

Instructions to Candidates:

- Answer any 4 full questions & missing data may be suitably assumed.

1A. Prove that the number of partition of an integer n with exactly k parts is equal to the number of partition of n whose largest part is k.

1B. In how many ways can the letters of the word CALCULATE be rearranged without any two adjacent letters being the same?

(5+5)

2A. Let $E(x_1, x_2, x_3) = (\overline{x_1} \wedge x_2 \wedge \overline{x_3}) \vee (x_1 \wedge \overline{x_2}) \vee (x_1 \wedge x_3)$ be a boolean expression over the two valued Boolean algebra $\{0, 1\}$. Express $E(x_1, x_2, x_3)$ as a both disjunctive and conjunctive normal forms.

2B. For elements a and b in a Boolean Algebra, show that $a \leq b$ if and only if $\bar{a} \vee b = 1$

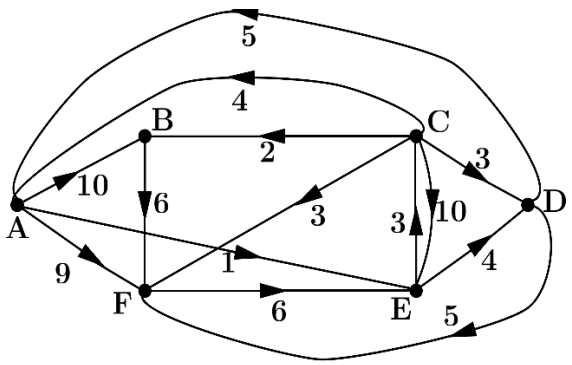
(5+5)

3A. Show that if G is a finite group and H is a subgroup of G, then the order of H divides the order of G.

3B. Define subgroup of a group. Let G be a group and $a, b \in G$. Define the set $H_b = \{bab^{-1} : a \in G\}$. Then check if H_b is a subgroup of G. Justify your conclusion.

(5+5)

4A. Find the shortest path from A to all other vertices for the network given in the diagram below using Dijkstra's Algorithm.



4B. Show that a tree with p vertices has p-1 edges.

(5+5)

5A. Show that from $(\exists x)\big(F(x) \wedge S(x)\big) \rightarrow (y)\big(M(y) \rightarrow W(y)\big)$ and $(\exists y)\big(M(y) \wedge \neg W(y)\big)$, the conclusion $(x)\big(F(x) \rightarrow \neg S(x)\big)$ follows.

5B. Check whether $A \longrightarrow \neg$D is a valid conclusion from the premises $A \longrightarrow (B \vee C)$, $B \longrightarrow \neg$A and $D \longrightarrow \neg$C ? Justify.

(5+5)

6A. Find the 30th permutation of five objects 1, 2,3, 4, 5 in Lexicographical and Fike's Order**.**

6B. Show that every cyclic group is abelian and check whether a group on 73 elements is Abelian? Justify your answer.

(5+5)