



INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI  
PhD-17 SHORT ABSTRACT OF THESIS

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Programme of Study : Ph.D.

Thesis Title: **Word-Representability of Graphs via Split Decomposition**

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Thesis Submitted to the Academic Division : Mathematics

Date of completion of Thesis Viva-Voce Exam : 06-07-2026

Key words for description of Thesis Work : Comparability graphs, Well-partitioned chordal graphs, modular decomposition, minimum word representant.

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**SHORT ABSTRACT**

The theory of word-representable graphs lies at the intersection of graph theory and combinatorics on words. This thesis uses a graph decomposition technique, viz., split decomposition, to study the theory of word-representable graphs. Further, the thesis constructs minimum-word-representants for certain classes of graphs.

In this thesis, a characterization of word-representable graphs with respect to split decomposition is obtained. Accordingly, the representation number of a word-representable graph is investigated in terms of the representation numbers of its split components. As a consequence, a characterization of word-representable graphs using modular decomposition is presented. In this context, a complete answer to the open problem posed by Kitaev and Lozin on the word-representability of the lexicographical product of graphs is obtained. Further, using split decomposition, the word-representability for specific subclasses of perfect graphs, viz., parity graphs, and well-partitioned chordal (WPC) graphs is established. In this connection, while it is shown that all parity graphs are word-representable, a characterization and a polynomial-time recognition algorithm for the word-representability of WPC graphs are presented. Moreover, the representation numbers of word-representable WPC graphs and that of split graphs are determined. In addition, a characterization of the class of (double-)arborescences in terms of their minimal split-decomposition trees is obtained and their minimum-word-representants are constructed. It is an open problem in the literature to find the classes of word-representable graphs whose minimum-word-representants are of length  $2n-k$ , where  $n$  is the number of vertices of the graph and  $k$  is its clique number. Contributing to the open problem, the class of treelike permutation graphs is shown as the first example satisfying the criterion of the aforementioned open problem, for an arbitrary  $k$ .