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## Notice for the PhD Viva Voce Examination

Mr Timmy Tomy Thalavayalil, Registration Number: 2190049, PhD Scholar at the Department of Mathematics, School of Sciences, CHRIST (Deemed to be University) will defend his PhD thesis at the public viva-voce examination on Friday, 22 May 2026 at 11.30 am in Room No. 044, Ground Floor, R&D Block, CHRIST (Deemed to be University), Bengaluru - 560029, Karnataka, India.

- Title of the Thesis** : **A Study on Some Transformations of Graphs**
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The members of the Research Advisory Committee of the Scholar, the faculty members of the Department and the School, interested experts and research scholars of all the branches of research are cordially invited to attend this open viva-voce examination.

**Place:** Bengaluru  
**Date:** 18 May 2026

**Registrar (Academics)**

## ABSTRACT

In this thesis, a comprehensive study on several newly defined graph transformations is presented. The dissertation introduces and investigates five types of transformed graphs derived from a simple, connected graph  $G$ : the deg-centric graph, exact deg-centric graph, upper deg-centric graph, lower deg-centric graph, and coarse deg-centric graph. The structural and foundational properties of these transformed graphs are examined in detail. The deg-centric graph of  $G$ , denoted by  $G_d$ , is defined with  $V(G_d) = V(G)$  and  $E(G_d) = \{v_i v_j : d_G(v_i, v_j) \leq \max\{\deg_G(v_i), \deg_G(v_j)\}\}$ . The exact deg-centric graph, denoted by  $G_{ed}$ , is constructed with  $V(G_{ed}) = V(G)$  and  $E(G_{ed}) = \{v_i v_j : d_G(v_i, v_j) = \deg_G(v_i)\}$ . The upper deg-centric graph, denoted by  $G_{ud}$ , is defined by  $V(G_{ud}) = V(G)$  and  $E(G_{ud}) = \{v_i v_j : d_G(v_i, v_j) \geq \min\{\deg_G(v_i), \deg_G(v_j)\}\}$ . The lower deg-centric graph, denoted by  $G_{ld}$ , is constructed with  $V(G_{ld}) = V(G)$  and  $E(G_{ld}) = \{v_i v_j : d_G(v_i, v_j) < \max\{\deg_G(v_i), \deg_G(v_j)\}\}$ . The coarse deg-centric graph, denoted by  $G_{cd}$ , is defined using  $V(G_{cd}) = V(G)$  and  $E(G_{cd}) = \{v_i v_j : d_G(v_i, v_j) > \min\{\deg_G(v_i), \deg_G(v_j)\}\}$ . Furthermore, this thesis investigates the iterative process of transforming a graph  $G$  into a complete graph through repeated applications of deg-centric-type operations. The number of iterations required for different graph classes is analysed. Additional results include an in-depth exploration of deg-centrication for various graph families, along with an examination of graph operations, colouring properties, and their corresponding transformed structures.

In addition, several illustrative examples are provided to demonstrate the construction and behaviour of the proposed transformations. The relationships between the original graphs and their transformed counterparts are systematically analysed to highlight key structural variations. The results obtained reveal how degree-based conditions influence connectivity patterns and graph parameters. This study also identifies potential directions for future research involving spectral properties and advanced invariants of these transformed graphs. Overall, the findings contribute valuable insights to the ongoing development of graph transformation. The proposed transformations collectively demonstrate how degree-distance relationships can be used to generate structurally meaningful graph models. The results obtained in this work indicate that these constructions preserve certain fundamental properties while significantly modifying others, offering new perspectives for structural comparison of graphs. The framework introduced here may serve as a basis for analysing invariant behaviour under transformation and for identifying classes of graphs with predictable deg-centric responses. Consequently, this study contributes to the systematic development of transformation-based approaches within modern graph theory. This work establishes a foundational framework for these new graph transformations and contributes to the broader understanding of structural graph theory and its applications.

**Keywords:** Distance, degree, eccentricity, deg-centric graphs, lower deg-centric graphs, exact deg-centric graphs, upper deg-centric graphs, coarse deg-centric graphs, coloring.

### Publications:

1. **T. T. Thalavayalil**, J. Kok, and S. Naduvath, "A study on deg-centric graphs", *Proyecciones*, Vol 43, no 2, pp 911–926, 2024.
2. **T. T. Thalavayalil**, J. Kok, and S. Naduvath, "A study on exact deg-centric" graphs, *J. Interconn. Networks*, pp 2450004, 2024.
3. **T. T. Thalavayalil**, S. Naduvath, "A study on coarse deg-centric graphs", *Gulf.J. Math.*, vol 16, no 2, pp 171–182, 2024.
4. **T. T. Thalavayalil**, J. Kok, and S. Naduvath, "A study on upper deg-centric graphs of graphs", *TWMS J. Appl. Eng. Math.*, vol 15, no 7, pp 1824-1835, 2025.
5. **T. T. Thalavayalil**, S. Naduvath, "A study on lower deg-centric graphs", *Palest.J. of Math.*, vol 14, no 2, pp 221–231, 2025.
6. **T. T. Thalavayalil**, S. Naduvath, "A study on deg-centric graphs of some graph families", *Palest. J. of Math.*, vol 14, no 1, pp 149–159, 2025