ONLINE

A MINI WORKSHOP ON GRAPHS, RINGS AND MODULES

OCTOBER 22, 2025

SPEAKERS

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- M. Ankitha (Pondicherry Uni.)
- T. Asir (Pondicherry Uni.)
- A. Güçlükan İlhan (Dokuz Eylül Uni.)
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Abstract Book

A MINI WORKSHOP ON GRAPHS, RINGS, AND MODULES

October 22, 2025

(Online Workshop)

Organized by
Dokuz Eylül University
Department of Mathematics
İzmir, Türkiye

Contents

Preface

Welcome to the *Book of Abstracts* for the online workshop entitled **A Mini Workshop on Graphs, Rings, and Modules**! This workshop brings together researchers and students from around the world to share ideas, explore new results, and discuss open problems in these areas of mathematics.

Graphs, rings, and modules connect beautifully across algebra and combinatorics, and we hope this event provides a space for learning, collaboration, and motivation. This book contains the abstracts of the talks presented during the workshop, as well as detailed information about the event.

We thank all speakers and participants for their time, effort, and dedication in making this workshop possible. We wish everyone an engaging and enjoyable experience!

Warm regards,

Organizing Committee

Program

GRM Online Workshop Program, 22 October, 2025	
Moderator: Engin MERMUT, Dokuz Eylül University, Türkiye	
09.15–09.30	*Opening*
09.30–10.10	T. ASIR, Pondicherry University, India
10.15–10.55	Salahattin ÖZDEMİR, Dokuz Eylül University, Türkiye
11.00–11.40	K. AKHIL, Pondicherry University, India
11.40–12.40	*Break*
Moderator: Evangeline Prathibham, Lady Doak College, India	
12.40–13.20	Zübeyir TÜRKOĞLU, Dokuz Eylül University, Türkiye
13.25–14.05	M. ANKITHA, Pondicherry University, India
14.10–14.50	Aslı GÜÇLÜKAN İLHAN, Dokuz Eylül University, Türkiye

Talks

The zero-divisor graph of a commutative ring

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Over the past 20 years, research on algebraic structures using graph theory tools has become increasingly interesting. The interaction between a ring's algebraic properties and the graph-theoretical properties of the corresponding graph is the subject of research on graphs made of rings. As an illustration, consider a ring's zero-divisor graph. Results regarding the fundamental characteristics of the zero-divisor graphs of commutative rings are presented in this talk.

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On Subinjectivity Domains of Finitely Generated Modules

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A module M is called *FG-injective* if every homomorphism from M to a finitely generated module K factors through an injective module, generalizing the injective modules properly. If the subinjectivity domain of M consists of exactly the FG-injective modules, then M is said to be *fg-indigent*. Properties of FG-injective modules and of fg-indigent modules are studied, and the concept of *si-portfolio* is considered for finitely generated modules. The collection of all subinjectivity domains of all finitely generated modules is also considered, and the cases where this collection forms a chain or has a single or two elements are investigated.

Joint work with Yılmaz Durğun Çukurova University, Adana-Türkiye
This study is supported by TÜBİTAK (Project no: 122F130).

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Cohen-Macaulay and Gorenstein Properties of the Cozero-Divisor Graph of $\mathbb{Z}_n$

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Let $n \geq 2$ be an integer and let $[n]^* = \{1, 2, \ldots, n-1\}$. The cozero-divisor graph of $\mathbb{Z}_n$ is defined by taking as vertices all elements of $\{x \in [n]^* : \gcd(x, n) \neq 1\}$, where two distinct vertices x and y are adjacent if and only if $\gcd(x, n)$ does not divide $\gcd(y, n)$ and $\gcd(y, n)$ does not divide $\gcd(x, n)$. Using this construction, I will explain how algebraic methods can be applied to study graph-theoretic properties. In particular, I will present characterizations of well-coveredness, Cohen–Macaulayness, vertex-decomposability, and Gorensteinness of these graphs and their complements. These results yield large classes of Cohen–Macaulay and non-Cohen–Macaulay graphs, illustrating deep connections between number-theoretic properties of n and the homological behavior of the associated cozero-divisor graph.

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On the Proper Flat Profiles of Some Classes of Modules

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One of the central topics in ring theory, module theory, and homological algebra is the characterization of rings in terms of whether certain classes of modules are projective, injective, or flat. In recent years, these notions have been studied from new perspectives, leading to alternative approaches and insights. In this context, dual interpretations of projectivity and injectivity have been investigated through the use of proper classes of short exact sequences.

In this talk, we introduce the concept of the right (or left) proper $\mathcal{M}$-flat profile $\tau(\mathcal{M})$ of a given class of right (or left) modules $\mathcal{M}$, defined as the class of proper classes generated flatly by each module in $\mathcal{M}$. We then focus on cases where the cardinality of the proper flat profile of all right modules is small (specifically 1, 2, or 3) and present certain characterizations of rings obtained via these profiles. In addition, we discuss structural results on rings under the condition that the proper flat profiles of all (finitely presented) right modules form a chain.

Joint Authors: Yılmaz Durğun, Salahattin Özdemir.
This work is supported by TÜBİTAK (Project No: 123F236).

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Cohen–Macaulayness of class of circulant graphs

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In this talk, well-covered and Cohen–Macaulay properties of a class of circulant graph is discussed, and providing classifications that distinguish large families of Cohen–Macaulay and non-Cohen–Macaulay graphs. For the integers $n \geq 3$ and $1 \leq k \leq \lfloor \frac{n-1}{2} \rfloor$, define the set

$$S_k = \{x \in [n] : \left\lfloor \frac{n-1}{2} \right\rfloor - k + 1 \leq x \leq \left\lceil \frac{n-1}{2} \right\rceil + k\}.$$

The circulant graph $Cir_n(S_k)$ is a simple graph with the vertex set $[n] = \{0, \ldots, n-1\}$, where two distinct vertices x and y are adjacent if and only if either $|x-y| \in S_k$ or $n - |x-y| \in S_k$. Talk begins by explaining concepts and results needed for our discussion, after that main result alongwith examples will be dicussed

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Leavitt Path Algebras of Graphs Defined over Groups

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Leavitt path algebras, introduced by Abrams-Aranda Pino and Ara-Moreno-Pardo, generalize Leavitt's original constructions that lack the invariant basis number (IBN) property. This talk focuses on Leavitt path algebras of graphs defined over groups, highlighting recent results on their structural properties and the IBN condition. We also compute Grothendieck groups of algebras arising from power and punctured power graphs of cyclic groups of prime power order, based on joint work with Müge Kanuni Er and Ekrem Şimşek.

This work is supported by TÜBİTAK (MFAG/124F202).

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