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Master in Mathematics

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MODULE HANDBOOK

Module Name	**Matrices over Rings**
Module level, if applicable	**Master**
Code, if applicable	**MMM 5207**
Subtitle, if applicable	
Courses, if applicable	**Matrices over Rings**
Semester(s) in which the module is taught	**First year**
Person responsible for the module	**Chair of Algebra Research Group**
Lecturer(s)	• **Prof. Dr. Sri Wahyuni** • **Dr. Ari Suparwanto** • **Dr. Sutopo**
Language	**Indonesia**
Relation to curriculum	**Elective courses**
Teaching methods	**Lecture, presentation**
Workload (incl. contact hours, self-study hours)	**(Estimated) Total workload:** **Contact hours: 150 minutes lectures per week, 180 minutes structured activities per week, 180 hours individual study, 16 weeks per semester (including mid-term and final examinations), in total 136 hours per semester.**
Credit points	**3**
Required and recommended prerequisites for joining the module	**Before taking this course, students must master the elementary linear algebra and introduction of ring theory.**

Module objectives/intended learning outcomes	**Upon successful completion of this course, students are able to:** ● **CO1: conclude and identify in detail an ideal of ring $M_{n\times n}(R)$ and prove their properties.** ● **CO2: conclude and identify in detail the generalization process of the rank of matrices and prove their properties.** ● **CO3: conclude, identify, and explain the solution of a system of linear equations over a ring, and prove the properties regarding the necessary and sufficient for a system of linear equations to have a solution (as generalization of linear equations over over field).** ● **CO 4: conclude and identify in detail the generalization process of Cayley-Hamilton Theorem and prove their properties** ● **CO 5: conclude and identify in detail the zero divisor in ring $M_{n\times n}(R)$ and prove the properties regarding the relation between zero divisor in ring R and zero divisor in ring $M_{n\times n}(R)$** ● **CO 6: conclude and identify in detail the eigen values and eigen vector of matrices over rings (as generalization of matrices over field) and prove the properties regarding the relation between eigen values and eigen vector and diagonalization of matrices over rings (as generalization of matrices over field).**
Content	● **Matrices with entries from a commutative ring R ($M_{n\times n}(R)$).** ● **Ideal of ring $M_{n\times n}(R)$.** ● **The rank of matrix over a commutative ring** ● **Linear system over rings.** ● **Primeness of ideal in R and primeness of ideal in $M_{n\times n}(R)$.** ● **The Cayley-Hamilton Theorem of Matrices over Rings.** ● **The Zero Divisor in ring $M_{n\times n}(R)$.** ● **the eigen values and eigen vector of matrices over rings** ● **Diagonalization of Matrices over Rings.**
Examination forms	**Oral presentation, essay, project**
Study and examination requirements	**The final mark will be weighted as follows:** **No Assessment methods (components, activities) Weight (percentage)** **1 Final Examination 20 – 30 %** **2 Mid-Term Examination 20 – 30 %** **3 Project 50 - 55 %** **To pass the course, the minimum grade is C.**
Media employed	**White Board, LCD Projector, Laptop/Computer**

Reading list	1. **Brown, W. C., 1984, *Matrices Over Commutative Rings*, Marcel Dekker, Inc.** 2. **Laksov, D, 2013, Diagonalization of Matrices Over Rings, *Journal of Algebra*.** 3. **Zabavsky B., 2005, Diagonalizability theorems for matrices over rings with finite stable range, *Algebra and Discrete Mathematics*.** 4. **Ara P., Goodearl K.R, O'meara K.C., and Pardo E., 1997, Diagonaliazation of matrices over regular rings, *Linear Algebra and its Applications*, Vol.265, pp-147-163.**

CO-PLO Mapping

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6
CO 1			**V**	**V**	**V**	
CO 2			**V**	**V**	**V**	
CO 3			**V**	**V**	**V**	
CO 4			**V**	**V**	**V**	

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