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Master in Mathematics

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MODULE HANDBOOK

Module Name	*Model Reduction of Bilinear Systems*
Module level, if applicable	*Master's degree*
Code, if applicable	*MMM -6313*
Subtitle, if applicable	-
Courses, if applicable	*Model Reduction of Bilinear Systems*
Semester(s) in which the module is taught	*2nd (second)*
Person responsible for the module	*Chair of the Lab. of Applied Mathematics*
Lecturer(s)	*Dr. Solikhatun, M. Si.*
Language	*Bahasa Indonesia*
Relation to curriculum	*Elective course in the first year (2nd semester) Master in Mathematics.*
Teaching methods	*Lectures, structured activities (assignments, quizzes, team-cases)*
Workload (incl. contact hours, self-study hours)	*Total workload is 136 hours per semester, which consists of 150 minutes lectures per week for 14 weeks, 180 minutes structured activities per week, 180 minutes individual study per week, in total is 16 weeks per semester, including mid exam and final exam.*
Credit points	*3*
Required and recommended prerequisites for joining the module	*Students should be have good knowledge in matrix algebra and differential equations.*

<table>
<tr><td>Module objectives/intended learning outcomes</td><td>After completing this course, the students have ability to:

CO 1. apply the principles of the model order reduction on linear and bilinear systems.

CO 2. apply several techniques of model order reduction on linear and bilinear systems.

CO 3. analyze the least upper bound of the different systems between the original system and reduced order systems.

CO 4. chose order of the reduced order systems based on least upper bounds of different bilinear systems and another properties.</td></tr>
<tr><td>Content</td><td>Model order reduction on linear systems. Roots Stability Array, Balanced truncation and singular perturbation methods. Solution and properties of bilinear systems. Model order reduction on bilinear systems. Balanced truncation, singular perturbation and Krylov subspace methods. Advanced topics.</td></tr>
<tr><td>Examination forms</td><td>Written assignments, written exams, quizzes and case based assignments.</td></tr>
<tr><td>Study and examination requirements</td><td>To pass the course, the minimum grade is C.
The final mark will be weighted as follows:
<table>
<tr><th>No</th><th>Assessment methods (components, activities)</th><th>Weight (percentage)</th><th>Cognitive</th><th>Case Based</th></tr>
<tr><td>1.</td><td>Final Examination (written exams)</td><td>35 %</td><td>20 %</td><td>15 %</td></tr>
<tr><td>2.</td><td>Mid-Term Examination</td><td>35 %</td><td>25 %</td><td>10 %</td></tr>
<tr><td>3.</td><td>Quiz, Homework (Written and case based assignments)</td><td>30 %</td><td>15 %</td><td>15 %</td></tr>
<tr><td></td><td>Total</td><td>100 %</td><td>60 %</td><td>40 %</td></tr>
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<tr><td>Media employed</td><td>Projector, board, computer, e-learning via http://elok.ugm.ac.id, simaster, online lecture via Zoom.</td></tr>
<tr><td>Reading list</td><td>[1] Elliot, D., 2009, Bilinear Control Systems: Matrices in Action, Springer.
[2] Olsder, G.J., dan Woude, J.W., 2003, Mathematical Systems Theory, Delft University Press.

[3] Solikhatun, 2016, Robust H∞ controller for bilinear systems by linear matrix inequalities, Doctoral Dissertation, Institut Teknologi Bandung.

[4] Saragih, R. dan Dewanti, I., 2012, Model Reduction of Bilinear System using Balanced Singular Perturbation, Computer Applications for Security, Control and Systems Engineering, Communication in Computer and Information Science 339.
[5] Zhou, K., and Doyle, J.C., 1997, Essential of Robust Control, Prentice Hall, California Institute of Technology.

[6] Trentlemen et.al, 2001, Control Theory for Linear Systems, Springer.</td></tr>
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CO and 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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