



**INSTITUT TEKNOLOGI SEPULUH NOPEMBER (ITS)**  
**FACULTY OF SCIENCE AND DATA ANALYTICS**  
**DEPARTMENT OF MATHEMATICS**

**Kode  
Dokumen**

**RENCANA PEMBELAJARAN SEMESTER / SEMESTER LEARNING PLAN**

MATA KULIAH (MK) COURSE	KODE CODE	Rumpun MK Course Cluster	BOBOT (sks) Credits		SEMESTER Semester	Tgl Penyusunan Compilation Date
<b>Asimilasi Data</b> <i>Data Assimilation</i>	<b>KM186217</b>	Matematika Terapan <i>Applied Mathematics</i>	<b>3</b>		<b>2</b>	
<b>OTORISASI / PENGESAHAN</b> <i>AUTHORIZATION / ENDORSEMENT</i>	<b>Dosen Pengembang RPS</b> <i>Developer Lecturer of Semester Learning Plan</i>		<b>Koordinator RMK</b> <i>Course Cluster Coordinator</i>		<b>Ka DEPARTEMEN</b> <i>Head of Department</i>	
	<b>Prof. Dr. Erna Apriliani, M.Si.</b>		<b>Prof. Dr. Basuki Widodo, M.Sc.</b>		<b>Subchan, S.Si., M.Sc., Ph.D</b>	
<b>Capaian Pembelajaran</b>	<b>CPL-PRODI yang dibebankan pada MK</b> <i>ILO Program Charged to The Course</i>					
<b>Learning Outcomes</b>	3.1.2	Mampu menguasai dan mengembangkan konsep-konsep matematika bidang pemodelan dan optimasi sistem <i>Able to master and develop mathematical concepts in the field of system modeling and optimization</i>				
	3.2.2	Mampu memformulasikan masalah nyata dalam model matematika <i>Able to formulate real problems in mathematical models</i>				
	4.1.2	Mampu menerapkan pokok-pokok matematika bidang pemodelan dan optimasi sistem untuk mendukung riset bidang lingkungan, pemukiman, kelautan, energi, atau teknologi informasi				

		<i>Able to apply mathematical principles in the field of modeling and system optimization to support research in the fields of environment, settlement, marine, energy, or information technology</i>
4.2.1		Mampu melakukan kajian tentang keakuratan suatu model matematis dari suatu permasalahan inter- atau multi-disiplin <i>Able to conduct studies on the accuracy of a mathematical model of an inter- or multi-disciplinary problem</i>
4.2.2		Mampu melakukan uji/simulasi secara numeric untuk mengetahui kinerja suatu metode komputasi <i>Able to perform numerical tests/simulations to determine the performance of a computational method</i>
Capaian Pembelajaran Mata Kuliah (CPMK) / <i>Course Learning Outcome (CLO)</i> Bila CP MK sbg penjabaran kemampuan setiap Tahap Pembelajaran dalam MK maka CPMK = Sub CPMK <i>If CLO as description capability of each Learning Stage in the course, then CLO = Lesson Learning Outcome (LLO)</i>		
<b>CPMK-1</b> <b>CLO 1</b>		Mahasiswa mampu menjelaskan metode asimilasi data dan model-model sistem dimana metode asimilasi data dapat digunakan <i>Students are able to explain data assimilation methods and system models in which data assimilation methods can be used</i>
<b>CPMK-2</b> <b>CLO 2</b>		Mahasiswa mampu menjelaskan beberapa metode estimasi dan perkembangan metode asimilasi data <i>Students are able to explain several estimation methods and the development of data assimilation methods</i>
<b>CPMK-3</b> <b>CLO 3</b>		Mahasiswa dapat menerapkan asimilasi data pada model dinamik stokastik dan deterministik <i>Students can apply data assimilation to stochastic and deterministic dynamic models</i>
<b>CPMK-4</b> <b>CLO 4</b>		Mahasiswa mampu menjelaskan dan menerapkan berbagai perkembangan algoritma filter Kalman dalam asimilasi data <i>Students are able to explain and apply various developments in the Kalman filter algorithm in data assimilation</i>
<b>Peta CPL – CP MK</b>  <b>Map of ILO - CLO</b>		

		CPL-1	CPL-2	CPL-3	CPL-4	CPL-5	CPL-6	
	CPMK-1							
	CPMK-2							
	CPMK-3							
	CPMK-4							
<b>Diskripsi Singkat MK</b>  <i>Short Description of Course</i>	<p>Pada kuliah ini akan dikaji tentang pengertian asimilasi data, perbandingan estimasi klasik dan asimilasi data, beberapa metode asimilasi data beserta penerapannya pada masalah estimasi sistem dinamik stokastik.</p> <p><i>In this course, the students learn the definition of data assimilation, comparing between classical estimation and data assimilation, the application of data assimilation to estimate the stochastic dynamical system.</i></p>							
<b>Bahan Kajian:</b> Materi pembelajaran  <i>Course Materials:</i>	<ul style="list-style-type: none"> <li>• Estimasi Klasik</li> <li>• Estimasi Model Stokastik</li> <li>• Pengembangan Metode Asimilasi Data</li> <li>• Terapan Metode Asimilasi Data</li>   <li>• <i>Classical Estimation</i></li> <li>• <i>Stochastic Model Estimation</i></li> <li>• <i>Development of Data Assimilation Methods</i></li> <li>• <i>Applications of Data Assimilation Methods</i></li> </ul>							
<b>Pustaka</b>  <i>References</i>	<p><b>Utama/Main:</b></p> <ol style="list-style-type: none"> <li>1. Lewis, J.M., Lakshmivarahan, Dhall, S.K., 2006, “<i>Dynamic Data Assimilation: A Least Squares Approach</i>”, Cambridge</li> <li>2. Kalnay, 2003, “<i>Atmospheric Modeling, Data Assimilation And Predictability</i>”, Cambridge</li> </ol> <p><b>Pendukung/Supporting:</b></p>							
<b>Dosen Pengampu</b> <i>Lecturers</i>	Prof. Dr. Erna Apriliani, M.Si.							

Matakuliah syarat <i>Prerequisite</i>		-					
Mg ke/ Week	Kemampuan akhir tiap tahapan belajar (Sub-CPMK) / <i>Final ability of each learning stage (LLO)</i>	Penilaian / <i>Assessment</i>		Bentuk Pembelajaran; Metode Pembelajaran; Penugasan Mahasiswa; <i>[ Estimasi Waktu] / Form of Learning; Learning Method; Student Assignment; [ Estimated Time]</i>		Materi Pembelajaran <i>[Pustaka] / Learning Material [Reference]</i>	Bobot Penilaian / <i>Assessment Load (%)</i>
		Indikator / <i>Indicator</i>	Kriteria & Teknik / <i>Criteria &amp; Techniques</i>	Tatap Muka / <i>In-class (5)</i>	Daring / <i>Online (6)</i>		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1-2	<ul style="list-style-type: none"> <li>• Mahasiswa mampu menjelaskan pengertian dan perkembangan metode asimilasi data</li> <li>• Mahasiswa mampu memberi contoh pemodelan matematika</li> <li>• <i>Students are able to explain the meaning and development of data assimilation methods</i></li> <li>• <i>Students are able to give examples of mathematical modeling</i></li> </ul>	<p>Ketepatan penjabaran perkembangan metode asimilasi data</p> <p><i>The accuracy in describing the development of the data assimilation method</i></p>	<p>Membuat resume pengertian dan perkembangan metode asimilasi data</p> <p><i>Make a resume of the definition and development of data assimilation methods</i></p>	<p>Kuliah</p> <p><i>Lecture</i></p>		<ul style="list-style-type: none"> <li>• Metode peramalan,</li> <li>• Pemodelan matematika <b>[1] Lewis, Bab 1</b></li> <li>• <i>Forecasting method</i></li> <li>• <i>Mathematical modeling</i> <b>[1] Lewis, Chapter 1</b></li> </ul>	
3-4	<p>Mahasiswa mampu mengidentifikasi model-model dimana metode asimilasi data dapat diterapkan</p>	<ul style="list-style-type: none"> <li>• ketepatan mengidentifikasi model-model yang dapat diestimasi dengan metode asimilasi data</li> </ul>	<p>Makalah</p> <p><i>Papers</i></p>	<p>Presentasi dan diskusi</p> <p><i>Presentation and discussion</i></p>		<ul style="list-style-type: none"> <li>• model-model yang digunakan dalam asimilasi data <b>[1] Lewis, Bab 3</b></li> <li>• <i>the models used in data assimilation</i></li> </ul>	

	<i>Students are able to identify which data assimilation models and methods can be applied</i>	<ul style="list-style-type: none"> <li>• Kejelasan deskripsi masalah asimilasi data</li> <li>• Accuracy in identifying models that can be estimated using the data assimilation method</li> <li>• Clarity of description of the data assimilation problem</li> </ul>				<a href="#">[1] Lewis, Chapter 3</a>	
5-6	<p>Mahasiswa mampu menerapkan dan melakukan estimasi klasik/ estimasi statistik</p> <p><i>Students are able to apply and perform classical estimation / statistical estimation</i></p>	<p>Kemampuan menganalisa perbedaan masing-masing metode estimasi</p> <p><i>Ability to analyze differences for each estimation method</i></p>		<p>Presentasi dan diskusi</p> <p><i>Presentation and discussion</i></p>		<ul style="list-style-type: none"> <li>• Prinsip estimasi statistik</li> <li>• estimasi least square</li> <li>• estimasi maximum likelihood</li> </ul> <p><a href="#">[1] Lewis, Bab 13-15</a></p> <ul style="list-style-type: none"> <li>• maximum likelihood estimate</li> </ul> <p><a href="#">[1] Lewis, Chapter 13-15</a></p>	
7	<p>Mahasiswa mampu menerapkan dan melakukan estimasi dinamik</p> <p><i>Students are able to apply and make dynamic estimates</i></p>	<p>Kemampuan menganalisa perbedaan masing-masing metode estimasi</p>		<p>Makalah dan presentasi</p> <p><i>Paper and presentation</i></p>		<ul style="list-style-type: none"> <li>• Estimasi variansi minimum linear</li> </ul> <p><a href="#">[1] Lewis, Bab 17, 27, 28</a></p> <ul style="list-style-type: none"> <li>• Linear minimum variance estimate</li> </ul> <p><a href="#">[1] Lewis, Chapter 17, 27, 28</a></p>	

		<i>Ability to analyze differences for each estimation method</i>					
8	<b>MIDTERM EXAM</b>						
9-10	<p>Mahasiswa mampu menjelaskan perkembangan algoritma Kalman filter</p> <p><i>Students are able to explain the development of the Kalman filter algorithm</i></p>	<p>Kemampuan untuk menerapkan dan menganalisa filter Kalman untuk model sistem sederhana</p> <p><i>Ability to apply and analyze Kalman filters for simple system models</i></p>	<p>Pemodelan dan program computer penerapan filter Kalman untuk melakukan estimasi</p> <p><i>Modelling and computer programming on Kalman filter application to estimate</i></p>	<p>Presentasi dan diskusi</p> <p><i>Presentation and discussion</i></p>		<p>Mahasiswa mampu menjelaskan perkembangan algoritma Kalman filter</p> <p><i>Students are able to explain the development of the Kalman filter algorithm</i></p>	
11-14	<p>Mahasiswa mampu membuat program dan melakukan simulasi dengan menggunakan algoritma extended filter Kalman, Ensemble Kalman filter</p> <p><i>Students are able to make programs and carry out simulations using the Kalman extended filter algorithm, the Ensemble Kalman filter</i></p>	<ul style="list-style-type: none"> <li>○ Presentasi dan diskusi</li> <li>○ Kejelasan uraian masing-masing algoritma</li> <li>○ Ketepatan identifikasi kelebihan, kekurangan dan penggunaan metode perkembangan Kalman Filter</li> </ul>	<p>Pembuatan program untuk berbagai metode estimasi dan beberapa model sistem dinamik stokastik tak linear</p> <p><i>Making programs for various estimation methods and</i></p>			<p>Mahasiswa mampu membuat program dan melakukan simulasi dengan menggunakan algoritma extended filter Kalman, Ensemble Kalman filter</p> <p><i>Students are able to make programs and carry out simulations using the Kalman extended filter</i></p>	

		<ul style="list-style-type: none"> <li>○ <i>Presentation and discussion</i></li> <li>○ <i>Clarity of description of each algorithm</i></li> <li>○ <i>Accurate identification of strengths, weaknesses and use of the Kalman Filter development method</i></li> </ul>	<p><i>some nonlinear stochastic dynamic system models</i></p>			<p><i>algorithm, the Ensemble Kalman filter</i></p>	
15	<ul style="list-style-type: none"> <li>● Mahasiswa mampu membuat makalah tentang metode asimilasi data khususnya filter Kalman berdasarkan jurnal-jurnal terbaru</li> <li>● Mahasiswa mampu mempresentasikan makalah yang telah dibuat</li> <li>● <i>Students are able to write papers on data assimilation methods, especially the Kalman filter based on the latest journals</i></li> <li>● <i>Students are able to present papers that have been made</i></li> </ul>	<ul style="list-style-type: none"> <li>○ Kejelasan deskripsi permasalahan estimasi dengan metode asimilasi data secara tertulis</li> <li>○ Kejelasan deskripsi dalam presentasi</li> <li>○ <i>A clear description of the estimation problem using the written data assimilation method</i></li> <li>○ <i>Clarity of description in presentation</i></li> </ul>	<p>Membaca jurnal dan menganalisa metode asimilasi data yang digunakan dalam jurnal tersebut</p> <p><i>Read the journal and analyze the data assimilation methods used in the journal</i></p>				
16	FINAL EXAM						

**TM**=Tatap Muka, **PT**=Penugasan Terstruktur, **BM**=Belajar Mandiri.  
**FF** = *Face to Face*, **SA** = *Structured Assignment*, **SS** = *Self Study*.