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*
Elementary Linear Algebra	KM184203	Analysis and Algebra	4		2	
OTORISASI / PENGESAHAN *AUTHORIZATION / ENDORSEMENT*	**Dosen Pengembang RPS** *Developer Lecturer of Semester Learning Plan*		**Koordinator RMK** *Course Cluster Coordinator*		**Ka DEPARTEMEN** *Head of Department*	
			(Jika ada) Tanda tangan		Tanda tangan	

Capaian Pembelajaran *Learning Outcomes*	**CPL-PRODI yang dibebankan pada MK** *ILO Program Charged to The Course*	
	CPL-1	[C2] Mahasiswa mampu mengidentifikasi dan menjelaskan pondasi matematika yang meliputi murni, terapan dan dasar-dasar komputasi.
	PLO-1	*[C2] Students are able to identify and explain foundations of mathematics that include pure, applied, and the basic of computing.*
	CPL-2	[C3] Mahasiswa mampu menyelesaikan permasalahan sederhana dan praktis dengan mengaplikasikan pernyataan matematika dasar, metode dan komputasi.
	PLO-2	*[C3] Students are able to solve simple and practical problems by applying basic mathematical statements, methods and computations.*
	Capaian Pembelajaran Mata Kuliah (CPMK) */ Course Learning Outcome (CLO)* Bila CP MK sbg penjabaran kemampuan setiap Tahap Pembelajaran dalam MK maka CPMK = Sub CPMK	

<table>
<tr><td></td><td colspan="2">If CLO as description capability of each Learning Stage in the course, then CLO = Lesson Learning Outcome (LLO)</td></tr>
<tr><td></td><td>CPMK-1

CLO-1</td><td>Mahasiswa mampu mengikuti perkembangan dan menerapkan matematika serta mampu berkomunikasi secara aktif dan benar baik lisan ataupun tulisan.
Students are able to follow developments and apply mathematics and are able to communicate actively and correctly both orally and in writing.</td></tr>
<tr><td></td><td>CPMK-2

CLO-2</td><td>Mahasiswa mampu menjelaskan secara cerdas dan kreatif tentang peranan signifikan aplikasi ALE dalam bidang rumpun pengetahuan terkait dan bidang lainnya serta menggunakan pemahaman yang diterima dalam kuliah untuk menyelesaikan masalah yang diberikan.
Students are able to explain intelligently and creatively about the significant role of ALE applications in related knowledge clusters and other fields and use the understanding received in lectures to solve given problems.</td></tr>
<tr><td></td><td>CPMK-3

CLO-3</td><td>Mahasiswa mempunyai kemampuan khusus dan mampu mengolah gagasannya yang cukup untuk mendukung studi berikutnya sesuai dengan bidang terkait..
Students have special abilities and are able to process sufficient ideas to support subsequent studies in accordance with the related field.</td></tr>
<tr><td>Peta CPL – CP MK</td><td colspan="2">
<table>
<tr><th></th><th>CPL-1</th><th>CPL-2</th><th>CPL-3</th><th>CPL-4</th><th>CPL-5</th><th>CPL-6</th></tr>
<tr><td>CPMK-1</td><td></td><td></td><td>V</td><td></td><td></td><td></td></tr>
<tr><td>CPMK-2</td><td></td><td></td><td>v</td><td>v</td><td></td><td></td></tr>
<tr><td>CPMK-3</td><td></td><td></td><td>v</td><td>v</td><td>v</td><td></td></tr>
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</td></tr>
<tr><td>Diskripsi Singkat MK</td><td colspan="2">Topik bahasan meliputi sistem persamaan linear dan solusinya, aljabar matriks, matriks invers, determinan dan ruang vektor real dimensi-n meliputi operasi vektor, norm dari vektor , hasil kali titik pada R^n, hasil kali silang pada R^n, basis, ruang baris, ruang kolom , ruang kosong, rank dan nulitas pada matriks, transformasi matriks, nilai eigen, vektor eigen dan diagonalisasi pada matriks, ruang hasil kali dalam.

Topics covered include systems of linear equations and their solutions, matrix algebra, inverse matrices, determinants and real vector spaces of n dimensions, including vector operations, norms of vectors, point product in R^n, cross product in R^n, base, row space, column space , blank space, rank and nullity of the matrix, transformation of the matrix, eigenvalues, eigenvectors and diagonalization of the matrix, inner product space.</td></tr>
<tr><td>Dosen Pengampu
Lecturers</td><td colspan="2">1. Sistem persamaan linear</td></tr>
</table>

	2. Determinan 3. Ruang vector Real 4. Nilai Eigen dan Vektor Eigen 5. Ruang hasil kali dalam *1. Systems of linear equations* *2. Determinants* *3. Real vector space* *4. Eigenvalues and Eigenvectors* *5. Inner product space*
Matakuliah syarat ***Prerequisite*** **Capaian Pembelajaran** ***Learning Outcomes***	**Utama:** **1.** Howard Anton and Chris Rorrers, ”Elementary Linear Algebra, Tenth Edition", John Wiley and Sons, (2010). **Pendukung:** 1. C.D. Meyer,”Matrix Analysis and Applied Linear Algebra”, SIAM, (2000) 2. Steven J. Leon, "Linear Algebra with Applications", Seventh Edition, Pearson Prentice Hall, (2006). 3. Stephen Andrilli and David Hecker,”Elementary Linear Algebra, Fourth Edition”, Elsevier, (2010) 4. Subiono., ”Ajabar Linier”, Jurusan Matematika FMIPA-ITS, 2016
Dosen Pengampu	Drs. I Gusti Ngurah Rai Usadha, M.Si Dr. Drs. Chairul Imron, MIKomp Dian Winda Setyawati, S.Si, M.Si
Matakuliah syarat	-

Mg ke/ ***Week***	**Kemampuan akhir tiap tahapan belajar (Sub-CPMK) /** ***Final ability of each learning stage (LLO)***	**Penilaian /** ***Assessment***		**Bantuk Pembelajaran; Metode Pembelajaran; Penugasan Mahasiswa;** **[Estimasi Waktu] /** ***Form of Learning; Learning Method; Student Assignment;*** ***[Estimated Time]***		**Materi Pembelajaran** **[Pustaka] /** ***Learning Material*** ***[Reference]***	**Bobot Penilaian /*Assess-ment Load* (%)**
		Indikator / ***Indicator***	**Kriteria & Teknik /** ***Criteria & Techniques***				
(1)	**(2)**	**(3)**	**(4)**	**Tatap Muka /** ***In-class* (5)**	**Daring /** ***Online* (6)**	**(7)**	**(8)**

1, 2	• Mahasiswa mampu menyelelesaikan SPL dengan metode eliminasi Gaussian atau Gauss Jordan serta mampu menjelaskan mengapa SPL tidak punya penyelesaian. • Mahasiswa mampu menggunakan operasi-operasi pada matriks dan memahami sifat – sfat aljabar pada matriks • *Students are able to complete the Linear system equation by the Gaussian or Gauss Jordan elimination method* *And able to explain why Linear system equation has no solution.* • *Students are able to use operations on the matrix and understand the algebraic properties of the matrix*	• Ketepatan mendefinisikan SPL dan matriks diperbesar. • Kemampuan menyelesaikan SPL dengan OBE • Mampu meyelesaikan SPL menggunakan Gaussian dan Gauss Jordan • Mampu menjelaskan sifat –sifat aljabar pada matriks • *The understanding of Linear system equation and augmented matrix* • *Elementary Row Operation* *Gaussian and Gauss Jordan elimination* • *Operation Matrix Properties of Algebra In Matrices*	Tugas Latihan soal *Task* *Exercises*	• Kuliah • Tanya Jawab • Memberi latihan • Diskusi Kelompok • *Lectures* • *Question and answer* • *Giving exercise* *Group discussion*	zoom myITS Classroom *zoom myITS Classroom*	• Pengertian SPL & Matriks diperbesar • Operasi Baris Elementer (OBE) • Eliminasi Gaussian dan Gauss Jordan • Operasi Matriks • Sifat Aljabar Pada Matriks **[Ref. 1 hal :9-98]** • *Understanding SST & Enlarged Matrix* • *Elementary Line Operations (OBE)* • *Elimination of Gaussian and Gauss Jordan* • *Matrix Operations* • *Algebraic Properties of Matrices* ***[Ref. 1 page: 9-98]***	
3	• Mahasiswa mampu mencari invers matrik, dapat menyelesaikan SPL dengan invers matriks.	• Mampu mendapatkan invers dari suatu matriks	Tugas Latihan soal *Task* *Exercises*	• Kuliah • Tanya Jawab • Memberi latihan • Diskusi Kelompok	zoom myITS Classroom *zoom myITS Classroom*	• Mencari Invers matriks • Menyelesaikan SPL dengan invers matriks	

	• Mahasiswa mengenal jenis-jenis matriks dan sifat –sifat pada matriks. • *Students are able to find inverse matrix, can complete Linear system equation with inverse matrix* • *Students recognize the types of matrices and properties of the matrix*	• Mampu menyelesaikan SPL dengan invers matriks • Mampu menjelaskan jenis – jenis serta sifat – sifat pada matriks • *Looking for Inverse matrix* • *Complete the Linear system equation with the inverse matrix* • *Matrix type: Diagonal matrix, triangular matrix, symmetry matrix and its properties*		• *Lectures* • *Question and answer* • *Giving exercise* *Group discussion*		• Jenis matriks : Matriks Diagonal, matriks triangular, matriks simetri dan sifat-sifatnya **[Ref. 1 hal :99-139]** • *Be able to get the inverse of a matrix* • *Able to complete Linear system equation with inverse matrix* • • *Be able to explain the types and properties of the matrix* **[Ref. 1 Page :99-139]**	
4	• Mahasiswa mampu mencari determinan dari suatu matriks dengan ekspansi Cofaktor • Mahasiswa mampu mencari determinan dari suatu matriks dengan Reduksi Baris • Mahasiswa mampu memahami sifat – sifat pada determinan	• Mampu Menghitung determinan dengan ekspansi Cofaktor • Mampu Menghitung determinan dengan Reduksi Baris • Mampu menjelaskan sifat – sifat pada determinan • Mampu menyelesaikan SPL dengan aturan cramer	Tugas Latihan soal *Task Exercises*	• Kuliah • Tanya Jawab • Memberi latihan • Diskusi Kelompok • *Lectures* • *Question and answer* • *Giving exercise* *Group discussion*	zoom myITS Classroom *zoom myITS Classroom*	• Menghitung determinan dengan ekspansi Cofaktor • Menghitung determinan dengan dengan Reduksi Baris • sifat – sifat pada determinan • menyelesaikan SPL dengan aturan cramer **[Ref. 1 hal :173-211]**	

	• Mahasiswa mampu menyelesaikan SPL dengan aturan cramer • *Students are able to find the determinant of a matrix with Cofactor expansion* • *Students are able to find the determinant of a matrix by Row Reduction* • *Students are able to understand the properties of the determinant* • *Students are able to complete the Linear system equation with the Cramer's rules*	• *Counting determinants with Cofactor expansion* • *Counting determinants by Reducing Rows* • *the properties of the determinant* • *complete Linear system equation with cramer rules*				• *Able to calculate determinants with Cofactor expansion* • *Capable of Counting determinants by Row Reduction* • *Be able to explain the properties of the determinant* • *Able to complete Linear system equation with Cramer rules* **[Ref. 1 Page :173-211]**	
5, 6	• Mahasiswa mampu memahami vektor pada ruang 2, ruang 3 dan ruang n serta operasi pada vektor • Mahasiswa mampu menentukan norm, hasil kali titik (dot produk), jarak, hasil kali silang (cross produk), himpunan orthogonal pada R^n, seta geometri dari Sistem linear • *Students are able to understand the vectors in space 2, space 3 and space n and operation on the vector*	• Mampu menjelaskan vektor pada ruang 2, ruang 3 dan ruang n • Mampu menjelaskan operasi pada vektor • Mampu menjelaskan dan norm, hasil kali titik (dot produk), jarak, hasil kali silang (cross produk), himpunan orthogonal pada R^n, seta geometri dari Sistem linear	Tugas Latihan soal *Task* *Exercises*	• Kuliah • Tanya Jawab • Memberi latihan • Diskusi Kelompok • *Lectures* • *Question and answer* • *Giving exercise* *Group discussion*	zoom myITS Classroom *zoom myITS Classroom*	• vektor pada ruang 2, ruang 3 dan ruang n • operasi pada vektor norm, hasil kali titik (dot product), jarak, cross product, himpunan orthogonal pada R^n, seta geometri dari Sistem linear **[Ref. 1 hal :226-320]** • *Able to explain vectors in space 2, space 3 and space n*	

	• *Students are able to define norm, product of point (product dot), distance, cross product, orthogonal set at R^n,, seta geometry from linear Ssstem*	• *Be able to explain vectors in space 2, space 3 and space n* • *Be able to explain operations on vectors* *Be able to explain and norm, product dot product, distance, cross product, orthogonal set in R^n, geometric set of linear system.*				• *Ability to explain and norm, dot product, distance, cross product, orthogonal set at R^n,, seta geometry of linear system* **[Ref. 1 Page :226-320]**	
7	• Mahasiswa mampu memahami ruang vektor real • Mahasiswa mampu memahami subruang vektor real • Mahasiswa mampu memahami kombinasi linear dan himpunan bebas linear • *Students are able to understand real vector spaces* • *Students are able to understand the real vector subspace* • *Students are able to understand linear and linearly independent combinations*	• Mampu menjelaskan ruang vektor real dan subruang vektor real • Mampu menjelaskan kombinasi linear dan himpunan bebas linear • *Be able to explain real vector space and real vector subspace* • *Be able to explain linear and linearly independent combinations* ▪	Tugas Latihan soal *Task* *Exercises*	• Kuliah • Tanya Jawab • Memberi latihan • Diskusi Kelompok • *Lectures* • *Question and answer* • *Giving exercise* *Group discussion*	zoom myITS Classroom *zoom myITS Classroom*	• ruang vektor real • subruang vektor real • kombinasi linear dan himpunan bebas linear **[Ref. 1 hal :328-375]** • *real vector space* • *real vector subspace* • *linear and linearly independent combinations* **[Ref. 1 hal :328-375]**	7
8	EVALUASI TENGAH SEMESTER *Mid Semester Evaluation*						

9, 10	• Mahasiswa mampu memahami basis dan dimensi dari suatu ruang vektor • Mahasiswa mampu menentukan koordinat relatif suatu vektor terhadap suatu basis pada ruang vektor • Mahasiswa mampu memahami ruang baris, ruang kolom, ruang kosong, rank, nulitas dari suatu matriks • *Students are able to understand the basis and dimension of a vector space* • *Students are able to determine the relative coordinates of a vector on a basis in a vector space* • *Students are able to understand the row space, column space, blank space, rank, nullity of a matrix*	• Basis • Dimensi ruang vektor • Koordinat Relatif • Matriks Transisi • Ruang Baris, Ruang Kolom, Ruang Kosong • Rank dan nulitas • *Base* • *The vector space dimension* • *Relative Coordinates* • *Standard Matrix* • *Row space, Column space, null space* • *Rank and nullity*	Tugas Latihan soal *Task* *Exercises*	• Kuliah • Tanya Jawab • Memberi latihan • Diskusi Kelompok • *Lectures* • *Question and answer* • *Giving exercise* *Group discussion*	zoom myITS Classroom *zoom myITS Classroom*	• Basis • Dimensi ruang vektor • Koordinat Relatif • Matriks Transisi • Ruang Baris, Ruang Kolom, Ruang Kosong • Rank dan nulitas **[Ref. 1 hal :377-455]** • *Base* • *The vector space dimension* • *Relative Coordinates* • *Standard Matrix* • *Row space, Column space, null space* • *Rank and nullity* **[Ref. 1 Page :377-455]**	
10-12	• Mahasiswa mampu memahami transformasi matriks dari R^n ke R^m • Mahasiswa mampu memahami Komposisi pada transformasi matriks	• Pengertian transformasi matriks dari R^n ke R^m dan jenis - jenisnya	Tugas Latihan soal *Task* *Exercises*	• Kuliah • Tanya Jawab • Memberi latihan • Diskusi Kelompok	zoom myITS Classroom *zoom myITS Classroom*	• Pengertian transformasi matriks dari R^n ke R^m dan jenis - jenisnya	

	• *Students be able to find standard matrix from R^n to R^m* • *Students be able to know well about composition function about standard matrix*	• Cara untuk mendapatkan Transformasi Matriks • Komposisi pada transformasi matriks • *Definition of standard matrix from R^n to R^m and its types.* • *How to get the Matrix representation* • *Composition about the standard matrix.*		• *Lectures* • *Question and answer* • *Giving exercise* *Group discussion*		• Cara untuk mendapatkan Transformasi Matriks • Komposisi pada transformasi matriks **[Ref. 1 hal :456-515]** • *Definition of standard matrix from R^n to R^m and its types.* • *How to get the Matrix representation* • *Composition about the standard matrix.* **[Ref. 1 Page :456-515]**	
13	• Mahasiswa mampu menentukan nilai eigen dan vektor eigen dari suatu matriks persegi • Mahasiswa mampu menentukan syarat matriks dapat didiagonalisasi dan dapat mendiagonalisasi matriks • *Students are able to determine the eigenvalues and eigenvectors of a square matrix* • *Students are able to determine the requirements*	• Nilai Eigen • Vektor Eigen • Diagonalisasi pada matrik A dengan matriks invertible P sehingga $D = P^{-1}AP$ • *Eigenvalues* • *Eigenvector* • *Diagonalization of matrix A with invertible matrix P so that $D = P^{-1}AP$*	Tugas Latihan soal *Task* *Exercises*	• Kuliah • Tanya Jawab • Memberi latihan • Diskusi Kelompok • *Lectures* • *Question and answer* • *Giving exercise* *Group discussion*	zoom myITS Classroom *zoom myITS Classroom*	• Nilai Eigen • Vektor Eigen • Diagonalisasi pada matrik A dengan matriks invertible P sehingga $D = P^{-1}AP$ **[Ref. 1 hal :539-569]** • *Eigenvalues* • *Eigenvector* • *Diagonalization of matrix A with invertible matrix P so that $D = P^{-1}AP$*	

	of the matrix to be diagonalizable and do matrix diagonalization					**[Ref. 1 Page :539-569]**	
14-15	• Mahasiswa mampu memahami hasil kali dalam pada ruang vektor real • Mahasiswa mampu memahami himpunan orthogonol pada ruang hasil kali dalam • Mahasiswa mampu membentuk basis orthonormal dengan melakukan proses gram-schmidt • *Students are able to understand inner product results in real vector spaces* • *Students are able to understand the set of orthogonol in the inner product space* • *Students are able to form an orthonormal basis by performing the Gram-Schmidt process*	• Pengertian Hasil kali Dalam • himpunan orthogonol pada ruang hasil kali dalam • Proses gram-schmidt • *Definition and its propeeties of inner product* • *the orthogonal set of inner product space* • *Gram-Schmidt process*	Tugas Latihan soal *Task Exercises*	• Kuliah • Tanya Jawab • Memberi latihan • Diskusi Kelompok • *Lectures* • *Question and answer* • *Giving exercise* *Group discussion*	zoom myITS Classroom *zoom myITS Classroom*	• Pengertian Hasil kali Dalam • himpunan orthogonol pada ruang hasil kali dalam • Proses gram-schmidt **[Ref. 1 hal :608-660]** • *Definition and its propeeties of inner product* • *the orthogonal set of inner product space* • *Gram-Schmidt process* **[Ref. 1 Page :608-660]**	
16	EVALUASI AKHIR SEMESTER						