



INSTITUT TEKNOLOGI SEPULUH NOPEMBER
FAKULTAS SAINS DAN ANALITIKA DATA
PROGRAM STUDI MAGISTER STATISTIKA
DEPARTEMEN STATISTIKA

Kode Dokumen

REV-1

RENCANA PEMBELAJARAN SEMESTER

MATA KULIAH (MK)		KODE	Rumpun MK	BOBOT (sks)		SEMESTER	Tgl Penyusunan
Desain Eskperimen Lanjut		SS255355	Statistika Dan Sains Data Lingkungan Dan Kesehatan	T=3	P=0	III	Agustus 2026
OTORISASI		Pengembang RPS		Koordinator RMK		Kepala PRODI	
		Dr. Sutikno, S.Si., M.Si.		Prof. Dr. Bambang Widjanarko Otok, S.Si, M.Si		Irhamah, S.Si, M.Si, Ph.D.	
Capaian Pembelajaran (CP) <i>Learning Outcome (LO)</i>	CPL-PRODI yang dibebankan pada MK						
	CPL-5 <i>PLO-5</i>	Mampu merancang, melaksanakan, dan mengevaluasi metodologi pengumpulan data terstruktur dan tidak terstruktur, serta modifikasi metode sampling dan pengumpulan data. <i>Able to design, implement, and evaluate methodologies for collecting both structured and unstructured data, including the modification of sampling and data-collection methods.</i>					
	CPL-7 <i>PLO-7</i>	Mampu menganalisis dan mengevaluasi teknik komputasi statistik untuk memecahkan permasalahan statistika yang kompleks berbasis data <i>Able to analyze and evaluate statistical computing techniques to address complex, data-driven statistical problems</i>					
	CPL-8 <i>PLO-8</i>	Mampu menganalisis dan mengevaluasi metode statistika untuk merumuskan solusi pada permasalahan teoritis dan riil dengan pendekatan multidisipliner <i>Able to analyze and evaluate statistical methodologies to formulate solutions for theoretical and real-world problems using a multidisciplinary approach.</i>					
	Capaian Pembelajaran Mata Kuliah (CPMK)						
	CPMK-1	Dapat menjelaskan konsep dasar desain eksperimen dan penyusunan model linier serta menganalisis perbandingan nilai tengah perlakuan dengan metode perbandingan berganda, dan kontras, serta penelusuran perubahan variabel respon melalui kontras polinomial orthogonal dan analisis regresi. <i>Can explain the basic concepts of experimental design and the formulation of linear models, analyze treatment mean comparisons using multiple comparison methods and contrasts, and trace changes in response variables through orthogonal polynomial contrasts and regression analysis.</i>					
	CPMK-2	Dapat menyusun rancangan percobaan dengan satu faktor dengan rancangan lingkungan: rancangan acak lengkap, rancangan acak kelompok lengkap dan rancangan acak kelompok tak lengkap, rancangan bujur sangkar latin. <i>Can design single-factor experiments with environmental designs: completely randomized design, randomized complete block design, incomplete randomized block design, and Latin square design.</i>					

Pembelajaran		
Pustaka	Utama :	
	1. Box, George EP, William G Hunter, and J Stuart Hunter. 1978. Statistics for Experimenters an Introduction to Design: Data Analysis and Model Building. John Wiley & Sons Inc. 2. Hinkelmann K, Kempthorne O.1994. Design and Analysis of Experiments. New York : John Wiley & Sons. 3. Kuehl RO. 2000. Design of Experiments: Statistical Principles of Research Design and Analysis. 4. Montgomery, D.C, 2005. Design and Analysis of Experiments. 6th edition. New York : John Wiley & Sons Inc. 5. Bagchi T.1994. Taguchi Methods Explained Practical Steps to Robust Design. John Wiley & Sons.New York	
	Pendukung :	
Dosen Pengampu	Dr. Sutikno, S.Si, M.Si; Prof. Dr. Drs. Purhadi, M.Sc	
Matakuliah syarat		

Mg Ke-	Kemampuan akhir tiap tahapan belajar (Sub-CPMK)	Penilaian		Bantuk Pembelajaran, Metode Pembelajaran, Penugasan Mahasiswa, [Estimasi Waktu]		Materi Pembelajaran [Pustaka]	Bobot Penilaian (%)
		Indikator	Kriteria & Bentuk	Luring (offline)	Daring (online)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Dapat menjeaskan konsep dasar desain eksperimen <i>Able to explain the basic concepts of experimental design</i>	1. Dapat menjelaskan beberapa teknik pengumpulan data untuk kebutuhan pengambilan keputusan 2. Dapat menjelaskan definisi: perlakuan, satuan amatan, unit eksperimen, level/taraf, faktor, variabel respon (pengukuran) 3. Dapat menjelaskan konsep replikasi, bloking, dan randomized 4. Dapat memberikan contoh desain eksperimen dalam kasus riel. 5. Dapat menjelaskan beberapa konsep tipe rancangan perlakuan, lingkungan, dan pengukuran (respon).	Latihan soal, diskusi <i>Exercises, discussion</i>	Ceramah interaktif, Latihan Soal, Diskusi Kuliah Lapangan 150 Menit <i>Interactive talks, Exercises, Discussion Field study</i> 150 Minutes		1. Review pengumpulan data untuk kebutuhan pengambilan keputusan 2. Definisi: rancangan percobaan, perlakuan, satuan amatan, unit eksperimen, level, faktor 3. Konsep replikasi, bloking, dan randomized 4. Beberapa contoh desain eksperimen pada kasus riel di bidang industri, pertanian, kedokteran 5. Beberapa konsep tipe rancangan perlakuan, lingkungan, dan pengukuran (respon).	7%/7%

Mg Ke-	Kemampuan akhir tiap tahapan belajar (Sub-CPMK)	Penilaian		Bantuk Pembelajaran, Metode Pembelajaran, Penugasan Mahasiswa, [Estimasi Waktu]		Materi Pembelajaran [Pustaka]	Bobot Penilaian (%)
		Indikator	Kriteria & Bentuk	Luring (offline)	Daring (online)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
		6. Dapat menjelaskan tahapan perancangan percobaan dan metodologi ilmiah 7. Dapat menjelaskan perkembangan disiplin ilmu desain eksperimen dan implementasinya. <i>1. Able to explain some data collection techniques for decision-making needs</i> <i>2. Able to explain definitions: treatment, observation units, experimental units, levels, factors, response variables (measurements)</i> <i>3. Able to explain the concepts of replication, blocking, and randomized</i> <i>4. Able to provide examples of experimental designs in the real case.</i> <i>5. Able to explain some concepts of treatment design types, environment, and measurement (response).</i> <i>6. Able to explain the stages of experimental design and scientific methodology</i> <i>Able to explain the development of experimental design disciplines and their implementation.</i>				6. Tahapan dalam perancangan percobaan dan metodologi ilmiah 7. Perkembangan disiplin ilmu desain eksperimen dan implementasinya <i>1. Review of data collection for decision-making needs</i> <i>2. Definition: experimental design, treatment, observation unit, experimental unit, level, factor</i> <i>3. Concepts of replication, blocking, and randomized</i> <i>4. Some examples of experimental designs on real cases in industry, agriculture, medicine</i> <i>5. Several concepts of treatment design types, environment, and measurement (response).</i> <i>6. Stages in the design of experiments and scientific methodologies</i> <i>Development of design disciplines and their implementation</i>	

Mg Ke-	Kemampuan akhir tiap tahapan belajar (Sub-CPMK)	Penilaian		Bantuk Pembelajaran, Metode Pembelajaran, Penugasan Mahasiswa, [Estimasi Waktu]		Materi Pembelajaran [Pustaka]	Bobot Penilaian (%)
		Indikator	Kriteria & Bentuk	Luring (offline)	Daring (online)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
2	Dapat menyusun rancangan percobaan dengan satu faktor dan rancangan acak lengkap (RAL) <i>Able to construct experimental design with one factor and completely randomized design (CRD)</i>	1. Dapat menerapkan rancangan percobaan satu faktor dengan rancangan acak lengkap 2. Dapat menyusun model linier dan tabel ANOVA rancangan satu faktor RAL. 3. Dapat menjelaskan estimasi parameter model linier ANOVA 4. Dapat menyusun pengujian hipotesis nilai tengah yang sesuai dalam rancangan satu faktor RAL dan mampu membedakan pengujian hipotesis nilai tengah yang sederhana. <i>1. Able to apply one-factor trial design with completely randomized design</i> <i>2. Able to construct linear models and ANOVA tables of one-factor CRD design.</i> <i>3. Able to explain the estimated parameters of the ANOVA linear model</i> <i>4. Able to construct a hypothesis testing of the corresponding middle value in the design of one factor CRD and be able to distinguish the simple middle value hypothesis testing.</i>	Tugas, Latihan soal, Tes, Laporan kuliah lapang <i>Assignments, exercises, tests, Field study report</i>	Ceramah interaktif, Latihan Soal, Diskusi, Kuliah lapang 150 Menit <i>Interactive talks, Exercises, Discussion Field study 150 Minutes</i>		1. Prosedur rancangan satu faktor dengan RAL 2. Identifikasi sumber keragaman dan penyusunan model linear, beserta keterangannya. 3. Deskripsi dan penurunan tabel ANOVA satu faktor RAL 4. Estimasi parameter model 5. Pengujian hipotesis nilai tengah (means models) dan model pengaruh (effect models). 6. Pengujian nilai tengah yang sederhana (uji t) 7. Ekplorasi data hasil perancangan percobaan (box-plot) 8. Pendeteksian asumsi model dan cara mengatasinya pelanggaran asumsi. 9. Perhitungan ANOVA tanpa dan dengan menggunakan software SAS dan Minitab <i>1. One-factor design procedure with CRD</i> <i>2. Identify the source of diversity and the preparation of linear models, along with their information</i>	7%/14%

Mg Ke-	Kemampuan akhir tiap tahapan belajar (Sub-CPMK)	Penilaian		Bantuk Pembelajaran, Metode Pembelajaran, Penugasan Mahasiswa, [Estimasi Waktu]		Materi Pembelajaran [Pustaka]	Bobot Penilaian (%)
		Indikator	Kriteria & Bentuk	Luring (offline)	Daring (online)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
						3. <i>Description and decline of ANOVA tables one factor CRD</i> 4. <i>Estimated model parameters</i> 5. <i>Testing of the middle value hypothesis (means models) and effect models (effect models).</i> 6. <i>Simple middle value test (t test)</i> 7. <i>Exploration of experimental design data (box-plot)</i> 8. <i>Detection of model assumptions and how to overcome them violations of assumptions</i> 1. <i>Calculation of ANOVA without and by using SAS and Minitab software</i>	
3	Dapat menganalisis perbandingan nilai tengah perlakuan dengan metode perbandingan berganda, dan kontras, serta penelusuran perubahan variabel respon	1. Dapat menganalisis perbandingan nilai tengah perlakuan dengan metode perbandingan berganda 2. Dapat menganalisis perbandingan nilai tengah dengan kontras orthogonal 3. Dapat menganalisis perbandingan nilai tengah dan penelusuran perubahan variabel respon melalui kontras polinomial orthogonal dan analisis regresi	Tugas, Latihan soal, Tes, Laporan kuliah lapang <i>Assignments, exercises, tests, Field study report</i>	Ceramah interaktif, Latihan Soal, Diskusi, Kuliah lapang 150 Menit <i>Interactive talks, Exercises,</i>		1. Perbandingan berganda dengan LSD, HSD, Duncan, Newman Keuls test, scheffe's methods 2. Perbandingan nilai tengah dengan kontras orthogonal 3. Penelusuran perubahan respon dengan kontras polinomial orthogonal. 4. Penelusuran perubahan respon dengan pendekatan analisis regresi	7%/21%

Mg Ke-	Kemampuan akhir tiap tahapan belajar (Sub-CPMK)	Penilaian		Bantuk Pembelajaran, Metode Pembelajaran, Penugasan Mahasiswa, [Estimasi Waktu]		Materi Pembelajaran [Pustaka]	Bobot Penilaian (%)
		Indikator	Kriteria & Bentuk	Luring (offline)	Daring (online)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	melalui kontras polinomial orthogonal dan analisis regresi <i>Able to analyze the comparison of middle value treatment with multiple comparison methods, and contrast, and search for the changes in response variables through orthogonal polynomial contrast and regression analysis</i>	<i>Able to analyze the comparison of the middle value of the treatment with multiple-comparable methods</i> <i>Able to analyze the ratio of middle values with orthogonal contrast</i> <i>Able to analyze middle value comparison and search for the changes in response variables through orthogonal polynomial contrast and regression analysis</i>		<i>Discussion Field study 150 Minutes</i>		- Eksplorasi data dalam perbandingan nilai tengah dan penelusuran perubahan variabel respon. - Perhitungan perbandingan berganda, kontras orthogonal dan kontras polinomial orthogonal tanpa dan dengan menggunakan software SAS dan Minitab <i>Multiple comparison with LSD, HSD, Duncan, Newman Keuls test, scheffe's methods</i> <i>Comparison of middle value with orthogonal contrast</i> <i>Search for response changes with orthogonal polynomial contrast.</i> <i>Search for response changes with regression analysis approach</i> <i>Explore data in middle value comparison and search for response variable changes.</i> <i>Calculation of multiple comparison, orthogonal contrast and orthogonal polynomial contrast without and using SAS and Minitab software</i>	

Mg Ke-	Kemampuan akhir tiap tahapan belajar (Sub-CPMK)	Penilaian		Bantuk Pembelajaran, Metode Pembelajaran, Penugasan Mahasiswa, [Estimasi Waktu]		Materi Pembelajaran [Pustaka]	Bobot Penilaian (%)
		Indikator	Kriteria & Bentuk	Luring (offline)	Daring (online)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
4	Dapat menyusun rancangan percobaan dengan satu faktor dan rancangan acak kelompok lengkap (RAKL) dan rancangan acak kelompok tak lengkap <i>Able to construct experiments with one factor and completely group randomized design (CGRD) and incompletely group randomized design</i>	1. Dapat menjelaskan prosedur perancangan satu faktor dengan RAKL. 2. Dapat menyusun model linier dan tabel ANOVA rancangan satu faktor RAKL dan rancangan acak kelompok tak lengkap. 3. Dapat melakukan estimasi dan menyusun pengujian hipotesis nilai tengah yang sesuai dalam rancangan satu faktor RAKL. 4. Dapat menyimpulkan hasil pengujian hipotesis <i>1. Able to explain the one-factor design procedure with CGRD.</i> <i>2. Able to construct linear models and ANOVA tables of one-factor RCGRD design and incompletely group randomized design.</i> <i>3. Able to perform estimation and do hypothesis testing of the appropriate middle value in the design of one factor CGRD.</i> <i>Able to infer the results of hypothesis testing</i>	Tugas, Latihan soal, Tes, Laporan kuliah lapang <i>Assignments, exercises, tests, Field study report</i>	Ceramah interaktif, Latihan Soal, Diskusi, Kuliah lapang 150 Menit <i>Interactive talks, Exercises, Discussion Field study 150 Minutes</i>		1. Prosedur perancangan satu faktor dengan RAKL, termasuk metode pengacakan perlakuan terhadap unit eksperimen. 2. Menyusun model linear RAKL dan dekomposisi sumber keragaman. 3. Membuat tabel ANOVA RAKL dan rancangan acak kelompok tak lengkap 4. Mendapatkan estimasi parameter dan menyusun pengujian yang sesuai berkaitan dengan RAKL dan rancangan acak kelompok tak lengkap 5. Perhitungan ANOVA RAKL tanpa dan dengan menggunakan software SAS dan Minitab <i>1. One-factor design procedures with CGRD, including methods of randomizing the treatment of experimental units.</i> <i>2. Construct a linear model of CGRD and decomposition of sources of diversity.</i> <i>3. Construct ANOVA CGRD tables and incompletely group randomized designs</i>	7%/28%

Mg Ke-	Kemampuan akhir tiap tahapan belajar (Sub-CPMK)	Penilaian		Bantuk Pembelajaran, Metode Pembelajaran, Penugasan Mahasiswa, [Estimasi Waktu]		Materi Pembelajaran [Pustaka]	Bobot Penilaian (%)
		Indikator	Kriteria & Bentuk	Luring (offline)	Daring (online)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
						4. Obtain parameter estimation and do appropriate tests relating to CGRD and incompletely group randomized design Calculation of ANOVA CGRD without and using SAS and Minitab software	
5	Dapat menyusun rancangan percobaan dengan satu faktor dan rancangan bujur sangkar latin (RBSL) <i>Able to construct an experimental design with one factor and latin square design (LSD)</i>	1. Dapat menyusun prosedur perancangan satu faktor dengan RBSL. 2. Dapat menyusun model linier dan tabel anova rancangan satu faktor RBSL. 3. Dapat melakukan estimasi dan menyusun pengujian hipotesis nilai tengah yang sesuai dalam rancangan satu faktor RBSL. 4. Dapat menyimpulkan hasil pengujian hipotesis <i>1. Able to construct a one-factor planning procedure with LSD.</i> <i>2. Able to construct linear models and anova tables of one factor design of LSD.</i> <i>3. Able to perform estimation and do hypothesis testing of the appropriate middle value in the one factor design of LSD.</i>	Tugas, Latihan soal, Tes, Laporan kuliah lapang <i>Assignments, exercises, tests, Field study report</i>	Ceramah interaktif, Latihan Soal, Diskusi, Kuliah lapang 150 Menit <i>Interactive talks, Exercises, Discussion Field study 150 Minutes</i>		1. Prosedur perancangan satu faktor dengan RBSL, termasuk metode pengacakan perlakuan terhadap unit eksperimen. 2. Menyusun model linear RBSL dan dekomposisi sumber keragaman. 3. Membuat tabel ANOVA RBSL 4. Mendapatkan estimator parameter dan menyusun pengujian hipotesis yang sesuai berkaitan dengan RBSL. 5. Menyusun RBSL dengan replikasi. 6. Perhitungan ANOVA RBSL dengan dan tanpa software SAS dan Minitab <i>1. One-factor design procedures with LSD, including methods of randomizing the treatment of experimental units.</i>	7%/35%

Mg Ke-	Kemampuan akhir tiap tahapan belajar (Sub-CPMK)	Penilaian		Bantuk Pembelajaran, Metode Pembelajaran, Penugasan Mahasiswa, [Estimasi Waktu]		Materi Pembelajaran [Pustaka]	Bobot Penilaian (%)
		Indikator	Kriteria & Bentuk	Luring (offline)	Daring (online)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
		<i>Able to infer the results of hypothesis testing</i>				2. <i>Construct a linear model of LSD and decomposition of sources of diversity.</i> 3. <i>Construct an ANOVA LSD table</i> 4. <i>Obtain a parameter estimator and do a test of the corresponding hypothesis relating to LSD.</i> 5. <i>Construct LSD by replication. Calculation of ANOVA LSD with and without SAS and Minitab software</i>	
6-7	Dapat menyusun rancangan percobaan dengan beberapa faktor (faktorial) dan beberapa rancangan lingkungan, serta menyusun pengujian hipotesis dengan faktor fixed, random dan mixed <i>Able to construct a trial design with several factors (factorial) and</i>	1. Dapat menjelaskan prosedur perancangan faktorial dengan berbagai rancangan lingkungan. 2. Dapat menyusun model linier dan tabel ANOVA rancangan faktorial dengan faktor fixed, faktor random, dan faktor mixed. 3. Dapat menyusun pengujian hipotesis nilai tengah yang sesuai dalam rancangan faktorial dengan faktor fixed, faktor random, dan faktor mixed. 4. Dapat menjelaskan konsep ekspektasi <i>mean square</i> dalam tabel ANOVA. 5. Dapat menyimpulkan hasil pengujian hipotesis	Tugas, Latihan soal, Tes, Laporan kuliah lapang <i>Assignments, exercises, tests, Field study report</i>	Ceramah interaktif, Latihan Soal, Diskus Kuliah lapang 300 Menit <i>Interactive talks, Exercises, Discussion Field study 300 Minutes</i>		1. Prosedur perancangan faktorial, termasuk metode pengacakan perlakuan terhadap unit eksperimen. 2. Menyusun model linear faktorial dan dekomposisi sumber keragaman. 3. Menyusun pengujian hipotesis (means, dan variance) yang sesuai dengan faktor fixed, faktor random, dan faktor mixed. 4. Metode perhitungan ekspektasi <i>mean square</i> baik faktor fixed, faktor random, dan faktor mixed dalam tabel ANOVA. 5. Membuat tabel ANOVA faktorial dengan faktor fixed,	14%/49%

Mg Ke-	Kemampuan akhir tiap tahapan belajar (Sub-CPMK)	Penilaian		Bantuk Pembelajaran, Metode Pembelajaran, Penugasan Mahasiswa, [Estimasi Waktu]		Materi Pembelajaran [Pustaka]	Bobot Penilaian (%)
		Indikator	Kriteria & Bentuk	Luring (offline)	Daring (online)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	<i>some environmental design, and construct hypothesis testing with fixed, random and mixed factors</i>	<i>1. Able to explain the factorial design procedure with various environmental designs.</i> <i>2. Able to construct linear models and ANOVA tables of factorial design with fixed factors, random factors, and mixed factors.</i> <i>3. Able to construct hypothesis testing of the appropriate middle value in the factorial design with fixed factors, random factors, and mixed factors.</i> <i>4. Able to explain the concept of mean square expectations in the ANOVA table.</i> <i>Able to infer the results of hypothesis testing</i>				faktor random, dan faktor mixed. 6. Perhitungan ANOVA faktorial tanpa dan dengan menggunakan software SAS dan Minitab <i>1. Factorial design procedures, including methods of randomizing the treatment of experimental units.</i> <i>2. Develop a linear model of factorial and decomposition of sources of diversity.</i> <i>3. Construct hypothesis testing (means, and variance) that corresponds to fixed factors, random factors, and mixed factors.</i> <i>4. The method of calculating mean square expectations are fixed factors, random factors, and mixed factors in the ANOVA table.</i> <i>5. Create factorial ANOVA tables with fixed factors, random factors, and mixed factors.</i> <i>Factorial ANOVA calculations without and using SAS and Minitab software</i>	

Mg Ke-	Kemampuan akhir tiap tahapan belajar (Sub-CPMK)	Penilaian		Bantuan Pembelajaran, Metode Pembelajaran, Penugasan Mahasiswa, [Estimasi Waktu]		Materi Pembelajaran [Pustaka]	Bobot Penilaian (%)
		Indikator	Kriteria & Bentuk	Luring (offline)	Daring (online)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
8	ETS						
9	Dapat menyusun rancangan percobaan faktorial 2^k <i>Able to construct a 2^k factorial experiment</i>	1. Dapat menjelaskan prosedur perancangan faktorial 2^k . 2. Dapat menyusun model linier dan tabel ANOVA rancangan faktorial 2^k . 3. Dapat menyusun pengujian hipotesis nilai tengah yang sesuai dalam rancangan faktorial. 4. Dapat menyimpulkan hasil pengujian hipotesis <i>1. Able to explain the factorial design procedure 2^k.</i> <i>2. Able to construct linear models and ANOVA tables of 2^k factorial design.</i> <i>3. Able to construct a hypothesis test of the appropriate middle value in the factorial design.</i> <i>Able to infer the results of hypothesis testing</i>	Tugas, Latihan soal, Tes, Laporan kuliah lapang <i>Assignments, exercises, tests, Field study report</i>	Ceramah interaktif, Latihan Soal, Diskusi Kuliah lapang 150 Menit <i>Interactive talks, Exercises, Discussion Field study 150 Minutes</i>		1. Konsep dasar rancangan percobaan faktorial 2^k dan prosedur pengacakan dengan berbagai rancangan lingkungan 2. Menyusun model linear faktorial 2^k dan dekomposisi sumber keragaman. 3. Membuat tabel ANOVA faktorial 2^k . 4. Menyusun pengujian hipotesis yang sesuai . 5. Perhitungan ANOVA faktorial 2^k tanpa dan dengan menggunakan software SAS dan Minitab <i>1. Basic concept of 2^k factorial trial design and randomization procedure with various environmental designs</i> <i>2. Construct a 2^k factorial linear model and decomposition of diversity sources.</i> <i>3. Create a factorial ANOVA table of 2^k.</i> <i>4. Construct appropriate hypothesis testing.</i> <i>Factorial ANOVA calculation of 2^k without and using SAS and</i>	7%/56%

Mg Ke-	Kemampuan akhir tiap tahapan belajar (Sub-CPMK)	Penilaian		Bantuk Pembelajaran, Metode Pembelajaran, Penugasan Mahasiswa, [Estimasi Waktu]		Materi Pembelajaran [Pustaka]	Bobot Penilaian (%)
		Indikator	Kriteria & Bentuk	Luring (offline)	Daring (online)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
						<i>Minitab software</i>	
10	Dapat menyusun rancangan percobaan Fraksional dan <i>confounding</i> serta percobaan <i>nested</i> <i>Able to construct fractional and confounding experiments and nested experiments</i>	1. Dapat menjelaskan prosedur perancangan fraksional. 2. Dapat menjelaskan prosedur perancangan <i>confounding</i> 3. Dapat menjelaskan prosedur perancangan percobaan <i>nested</i> . 4. Dapat menyusun model linier dan tabel ANOVA rancangan <i>nested</i>. 5. Dapat menyusun pengujian hipotesis nilai tengah yang sesuai dalam rancangan <i>nested</i>. 6. Dapat menyimpulkan hasil pengujian hipotesis <i>1. Able to explain fractional design procedures.</i> <i>2. Able to explain confounding design procedures</i> <i>3. Able to explain the nested trial design procedure.</i> <i>4. Able to construct linear models and nested design ANOVA tables.</i> <i>5. Able to construct a hypothesis testing of the appropriate middle value in a nested design.</i> <i>Able to infer the results of hypothesis testing</i>	Tugas, Latihan soal, Tes, <i>Assignments, exercises, tests</i>	Ceramah interaktif, Latihan Soal, Diskusi 150 Menit <i>Interactive talks, Exercises, Discussion Field study 150 Minutes</i>		1. Rancangan faktorial fraksional dengan berbagai metode. 2. Rancangan <i>confounding</i> 3. Prosedur perancangan percobaan <i>nested</i> 4. Menyusun model linear percobaan <i>nested</i>. 5. Menyusun tabel ANOVA rancangan <i>nested</i>. 6. Menyusun pengujian hipotesis nilai tengah yang sesuai dalam rancangan <i>nested</i> 7. Perhitungan ANOVA rancangan <i>nested</i> tanpa dan dengan menggunakan software SAS dan Minitab <i>1. Fractional factorial design by various methods.</i> <i>2. Confounding design</i> <i>3. Nested experiment design procedure</i> <i>4. Construct a linear model of nested experiments.</i> <i>5. Construct a nested design ANOVA table.</i> <i>6. Construct a hypothesis test of the appropriate middle value in a nested design</i> <i>Calculation of ANOVA nested</i>	7%/63%

Mg Ke-	Kemampuan akhir tiap tahapan belajar (Sub-CPMK)	Penilaian		Bantuk Pembelajaran, Metode Pembelajaran, Penugasan Mahasiswa, [Estimasi Waktu]		Materi Pembelajaran [Pustaka]	Bobot Penilaian (%)
		Indikator	Kriteria & Bentuk	Luring (offline)	Daring (online)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
						<i>design without and using SAS and Minitab software</i>	
11	Dapat menyusun rancangan percobaan dengan metode respon surface <i>Able to design experiments with response surface methods</i>	1. Dapat menjelaskan prosedur perancangan percobaan respon surface. 2. Dapat menyusun model respon surface 3. Dapat menjelaskan estimasi parameter dan pengujian hipotesis dalam respon surface. 4. Dapat menentukan kondisi optimum respon <i>1. Able to explain the procedure of designing response surface experiments.</i> <i>2. Able to develop response surface model</i> <i>3. Able to explain parameter estimation and hypothesis testing in response surface.</i> <i>Able to determine optimum response condition</i>	Tugas, Latihan soal, Tes <i>Assignments, exercises, tests</i>	Ceramah interaktif, Latihan Soal, Diskusi 150 Menit <i>Interactive talks, Exercises, Discussion Field study 150 Minutes</i>		1. Rancangan percobaan respon surface 2. Menyusun model respon surface 3. Estimasi dan pengujian respon surface 4. Penentuan kondisi optimum 5. Analisis respon surface dengan software SAS dan Minitab <i>1. Response surface experiment design</i> <i>2. Develop a response surface model</i> <i>3. Response surface estimation and testing</i> <i>4. Determination of optimum conditions</i> <i>Response surface analysis with SAS and Minitab software</i>	7%/70%
12	Dapat menyusun rancangan percobaan <i>split plot</i> dan perluasannya <i>Able to construct a split plot</i>	1. Dapat menjelaskan prosedur perancangan split-plot. 2. Dapat menyusun model linier dan tabel ANOVA rancangan split plot. 3. Dapat menyusun pengujian hipotesis nilai tengah yang sesuai dalam rancangan split plot.	Tugas, Latihan soal, Tes, Laporan kuliah lapang <i>Assignments, exercises,</i>	Ceramah interaktif, Latihan Soal, Diskusi 150 Menit		1. Prosedur perancangan percobaan split plot. 2. Menyusun model linear percobaan split plot. 3. Menyusun tabel ANOVA rancangan split plot.	7%/77%

Mg Ke-	Kemampuan akhir tiap tahapan belajar (Sub-CPMK)	Penilaian		Bantuk Pembelajaran, Metode Pembelajaran, Penugasan Mahasiswa, [Estimasi Waktu]		Materi Pembelajaran [Pustaka]	Bobot Penilaian (%)
		Indikator	Kriteria & Bentuk	Luring (offline)	Daring (online)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	<i>experiment and its expansion</i>	4. Dapat menyimpulkan hasil pengujian hipotesis <i>1. Able to explain the split-plot design procedure.</i> <i>2. Able to construct linear models and ANOVA tables of split plot designs.</i> <i>3. Able to construct a hypothesis testing of the corresponding middle value in the split plot design.</i> <i>Able to infer the results of hypothesis testing</i>	<i>tests, Field study report</i>	<i>Interactive talks, Exercises, Discussion Field study 150 Minutes</i>		4. Menyusun pengujian hipotesis nilai tengah yang sesuai dalam rancangan split plot 5. Perhitungan ANOVA rancangan split tanpa dan dengan menggunakan software SAS dan Minitab <i>1. The procedure of split plot experimental design.</i> <i>2. Construct a linear model of the split plot experiment.</i> <i>3. Construct an ANOVA table of split plot designs.</i> <i>4. Construct a hypothesis testing of the corresponding middle value in a split plot design</i> <i>Calculation of ANOVA split design without and using SAS and Minitab software</i>	
13	Dapat menganalisis hasil percobaan dengan analisis kovariansi <i>Able to analyze the results of experiments</i>	1. Mampu menjelaskan definisi dan rancangan percobaan dengan analisis kovarian 2. Mampu menyusun model linear dengan analisis kovarian 3. Mampu mendapatkan estimator dan pengujian hipotesis parameter	Tugas, Latihan soal, Tes <i>Assignments, exercises, tests</i>	Ceramah interaktif, Latihan Soal, Diskusi 150 Menit <i>Interactive talks, Exercises,</i>		1. Definisi dan rancangan percobaan dengan analisis kovarian 2. Model linear dengan analisis kovarian 3. Estimasi dan pengujian hipotesis parameter <i>1. Definition and design of experiments with covariance analysis</i>	7%/84%

Mg Ke-	Kemampuan akhir tiap tahapan belajar (Sub-CPMK)	Penilaian		Bantuk Pembelajaran, Metode Pembelajaran, Penugasan Mahasiswa, [Estimasi Waktu]		Materi Pembelajaran [Pustaka]	Bobot Penilaian (%)
		Indikator	Kriteria & Bentuk	Luring (offline)	Daring (online)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	<i>with covariance analysis</i>	1. <i>Able to explain the definition and design of experiments with covariance analysis</i> 2. <i>Able to construct linear models with covariance analysis</i> <i>Able to obtain estimators and parameter of hypothesis testing</i>		<i>Discussion Field study 150 Minutes</i>		2. <i>Linear model with covariance analysis</i> <i>Estimation and parameter hypothesis testing</i>	
14-15	Mampu merancang dan menganalisis percobaan dengan metode Taguchi <i>Able to design and analyze experiments with taguchi methods</i>	1. Mampu menjelaskan konsep dasar metode Taguchi 2. Mampu menyusun prosedur percobaan Taguchi: perencanaan, pelaksanaan, dan analisis data 3. Mampu menyusun model linier percobaan Taguchi 4. Mampu menjelaskan Estimasi dan pengujian hipotesis 5. Mampu menentukan kondisi optimum proses 1. <i>Able to explain the basic concepts of the Taguchi method</i> 2. <i>Able to construct Taguchi experimental procedures: plan, execute, and analyze data</i> 3. <i>Able to construct a linear model of taguchi experiments</i> 4. <i>Able to explain estimation and hypothesis testing</i> 5. <i>Able to determine the optimum condition of the process</i>	Tugas, Latihan soal, Tes <i>Assignments, exercises, tests</i>	Ceramah interaktif, Latihan Soal, Diskusi 300 Menit <i>Interactive talks, Exercises, Discussion Field study 300 Minutes</i>		1. Konsep dasar metode Taguchi 2. Prosedur percobaan Taguchi: perencanaan, pelaksanaan, dan analisis data 3. Model linier percobaan Taguchi 4. Estimasi dan pengujian hipotesis 5. Penentuan kondisi optimum proses 1. <i>Basic concepts of the Taguchi method</i> 2. <i>Taguchi experimental procedures: planning, execute, and analyze data</i> 3. <i>Taguchi experimental linear model</i> 4. <i>Estimation and hypothesis testing</i> <i>Determination of the optimum condition of the process</i>	16%/100%

Mg Ke-	Kemampuan akhir tiap tahapan belajar (Sub-CPMK)	Penilaian		Bantuk Pembelajaran, Metode Pembelajaran, Penugasan Mahasiswa, [Estimasi Waktu]		Materi Pembelajaran [Pustaka]	Bobot Penilaian (%)
		Indikator	Kriteria & Bentuk	Luring (offline)	Daring (online)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
16	EAS						