MODULE HANDBOOK

EXPERIMENTAL DESIGN

BACHELOR DEGREE PROGRAM
DEPARTEMENT OF STATISTICS
FACULTY OF SCIENCE AND DATA ANALYTICS
INSTITUT TEKNOLOGI SEPULUH NOPEMBER

ENDORSEMENT PAGE

	MODULE HANDBOOK **EXPERIMENTAL DESIGN** **DEPARTMENT OF STATISTICS** **INSTITUT TEKNOLOGI SEPULUH NOPEMBER**

Proses ***Process***	**Penanggung Jawab** ***Person in Charge***			**Tanggal** ***Date***
	Nama ***Name***	**Jabatan** ***Position***	**Tandatangan** ***Signature***	
Perumus *Preparation*	Dr. Drs. Purhadi, M.Sc	Dosen *Lecturer*		**March 28, 2019**
Pemeriksa dan Pengendalian *Review and Control*	Dr. Drs. Purhadi, M.Sc ; Dra. Wiwiek Setya Winahju, M.S. ; Dr. Sutikno, S.Si, M.Si ; Muhammad Sjahid Akbar, S.Si, M.Si	Tim kurikulum *Curriculum team*		**April 15, 2019**
Persetujuan *Approval*	Dr. Santi Wulan Purnami, M.Si	Koordinator RMK *Course Cluster Coordinator*		**July 17, 2019**
Penetapan *Determination*	Dr. Kartika Fithriasari, M.Si	Kepala Departemen *Head of Department*		**July 30, 2019**

MODULE HANDBOOK

EXPERIMENTAL DESIGN

Module name	**EXPERIMENTAL DESIGN**	
Module level	Undergraduate	
Code	KS184408	
Course (if applicable)	EXPERIMENTAL DESIGN	
Semester	Fourth Semester (Genap)	
Person responsible for the module	Dr. Drs. Purhadi, M.Sc	
Lecturer	Dr. Drs. Purhadi, M.Sc ; Dra. Wiwiek Setya Winahju, M.S. ; Dr. Sutikno, S.Si, M.Si ; Muhammad Sjahid Akbar, S.Si, M.Si	
Language	Bahasa Indonesia and English	
Relation to curriculum	Undergradute degree program, **mandatory**, 4th semester.	
Type of teaching, contact hours	Lectures, <50 students	
Workload	1. Lectures : 3 x 50 = 180 minutes per week. 2. Exercises and Assignments : 3 x 60 = 180 minutes (3 hours) per week. 3. Private learning : 3 x 60 = 180 minutes (3 hours) per week.	
Credit points	3 credit points (sks)	
Requirements according to the examination regulations	A student must have attended at least 80% of the lectures to sit in the exams.	
Mandatory prerequisites	Analisis Regresi /Regression Analysis	
Learning outcomes and their corresponding PLOs	*CLO. 1 Explain the use of experimental design concepts indata collection.* *CLO. 2 Can formulate experimental designs with one factor and completely randomized design* *CLO. 3 Can analyze value comparisons middle treatment with multiple comparison and contrast methods, as well as tracking changes in response variables through orthogonal polynomial contrast and regression analysis.* *CLO. 4 Able to utilize science and technology to process data onexperimental results.* *CLO. 5 Be able to compile experimental designs with one factor and random designof complete groups, incomplete randomized block design, Latin square design and compiling a two-factor experimental* .	PLO-01 PLO-02 PLO-03

	CLO .6 Able to make correct decisions based on experimental results and able to communicate the results of analysis both verbally and in writing *CLO .7 Able to communicate Effective and collaborating in an interdisciplinary and multidisciplinary team.* *CLO. 8 Have professional responsibility and work ethics* *CLO. 9 Able to motivate oneself to think creatively and learn lifelong*	PLO-07
Content	*The purpose of this course is making students are able to design data collection through experiments and be able to analyze experimental data and interpret it. The theoretical material of various environmental designs and treatment designs is conveyed through lectures and discussions. Likewise, data analysis material is conveyed through discussion and discussion as well as practicum in class with and without software (software). In addition, students are given assignments, both independently and in groups, to identify the application of various designs to real problems, either by self-observation or through field studies at government agencies or industries whereactivities are available research and development. The purpose of this assignment is to train students to be able to manage and work in teams and to be responsible for the results of independent and group work.*	
Study and examination requirements and forms of examination	• In-class exercises • Assignment 1, 2, 3 • Mid-term examination • Final examination	
Media employed	LCD, whiteboard, websites (myITS Classroom), zoom.	
Reading list	1. Box, George EP, William G Hunter, and J Stuart Hunter. 1978. Statistics for EXPERIMENTALers an Introduction to Design: Data Analysis and Model Building. John Wiley dan Sons Inc. 2. Hinkelmann K, Kempthorne O.1994. Design and Analysis of EXPERIMENTALs. New York: John Wiley danSons. 3. Kuehl RO. 2000. Design of EXPERIMENTALs: Statistical Principles of Research Design and Analysis. 4. Montgomery, D.C, 2005. Design and Analysis of EXPERIMENTALs. 6th edition. New York: John Wiley dan Sons Inc.	

	Program Studi	Sarjana, Departemen Statistika, FMKSD-ITS
	Mata Kuliah	Desain Eksperimen
	Kode Mata Kuliah	KS184408
	Semester/SKS	IV/3
	MK Prasyarat	Analisis Regresi
RP-S1	Dosen Pengampu	Dr. Drs. Purhadi, M.Sc ; Dra. Wiwiek Setya Winahju, M.S. ; Dr. Sutikno, S.Si, M.Si ; Muhammad Sjahid Akbar, S.Si, M.Si

Bahan Kajian *Study Materials*	Dasar Sains, Teori Statistika, Pengumpulan Data, Deskripsi dan Eksplorasi, Komputasi dan Data Processing, Pemodelan, Industri dan Bisnis, Pemerintahan dan Kependudukan, Ekonomi dan Manajemen, Kesehatan dan Lingkungan, dan Sosial Humaniora *Basic of Science, Statistical Theory, Data Collection, Description and Exploration, Computing and Data Processing, Modeling, Industry and Business, Government and Population, Economics and Management, Health and Environment, and Social Humanities*
CPL yang dibebankan MK *PLO*	CPL-1 Mampu menerapkan pengetahuan teori statistika, matematika, dan komputasi CPL-2 Mampu merancang dan melaksanakan pengumpulan data dengan metodologi yang benar CPL-3 Mampu menganalisis data dengan metode statistika yang tepat dan mengintepretasikannya CPL-7 Mampu berkomunikasi secara efektif dan bekerjasama dalam tim yang interdisiplin dan multidisiplin *PLO-1 Able to apply knowledge of statistical theory, mathematics, and computation* *PLO-2 Able to design and carry out data collection with correct methodology* *PLO-3 Able to analyze data with appropriate statistical methods and interpret it* *PLO-7 Able communicate effectively and cooperate in interdisciplinary and multidisciplinary teams*
CP-MK *CLO*	CPMK.1 Menjelaskan penggunaan konsep desain eksperimen dalam pengumpulan data CPMK.2 Dapat menyususn rancangan percobaan dengan satu faktor dan rancangan acak lengkap (RAL) CPMK.3 Dapat menganalisis perbandingan nilai tengah perlakuan dengan metode perbandingan berganda, dan kontras, serta penelusuran perubahan variabel respon melalui kontras polinomial orthogonal dan analisis regresi CPMK.4 Mampu memanfaatkan IPTEKS untuk mengolah data hasil eksperimen CPMK.5 Dapat menyusun rancangan percobaan dengan satu faktor dan rancangan acak kelompok lengkap (RAKL), rancangan acak kelompok tak lengkap, Rancangan Bujur Sangkar Latin (RBSL) dan menyusun rancangan percobaan dua faktor CPMK.6 Mampu mengambil keputusan yang tepat berdasarkan hasil eksperimen dan mampu mengkomunikasikan hasil analisis baik secara lisan maupun tertulis CPMK.7 Mampu berkomunikasi secara efektif dan bekerjasama dalam tim yang interdisiplin dan multidisiplin CPMK.8 Memiliki tanggung jawab dan etika profesi CPMK.9 Mampu memotivasi diri untuk berpikir kreatif dan belajar sepanjang hayat *CLO. 1 Explain the use of experimental design concepts indata collection.*

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	CLO. 2 Can formulate experimental designs with one factor and completely randomized design *CLO. 3 Can analyze value comparisons middle treatment with multiple comparison and contrast methods, as well as tracking changes in response variables through orthogonal polynomial contrast and regression analysis.* *CLO. 4 Able to utilize science and technology to process data onexperimental results.* *CLO. 5 Be able to compile experimental designs with one factor and random designof complete groups, incomplete randomized block design, Latin square design and compiling a two-factor experimental* *CLO .6 Able to make correct decisions based on experimental results and able to communicate the results of analysis both verbally and in writing* *CLO .7 Able to communicate Effective and collaborating in an interdisciplinary and multidisciplinary team.* *CLO. 8 Have professional responsibility and work ethics* *CLO. 9 Able to motivate oneself to think creatively and learn lifelong*

Perte-muan *Meeting*	**Kemampuan Akhir Sub CP-MK** *Final Ability*	**Keluasan (materi pembelajaran)** *Extent (learning material)*	**Metode Pembelajaran** *Learning methods*	**Estimasi Waktu** *Duration*	**Bentuk Evaluasi** *Evaluation Type*	**Kriteria dan Indikator Penilaian** *Assessment Criteria and Indicators*	**Bobot Penilaian** *Scoring*
1	1. Dapat menjeaskan konsep dasar desain eksperimen	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	Ceramah interaktif, Latihan Soal, Diskusi	150 menit	Latihan soal, diskusi	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	7%/7%

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		di bidang industri, pertanian, kedokteran 5. Beberapa konsep tipe rancangan perlakuan, lingkungan, dan pengukuran (respon). 6. Tahapan dalam perancangan percobaan dan metodologi ilmiah Perkembangan disiplin ilmu desain eksperimen dan implementasinya				4. Dapat memberikan contoh desain eksperimen dalam kasus riel. 5. Dapat menjelaskan beberapa konsep tipe rancangan perlakuan, lingkungan, dan pengukuran (respon). 6. Dapat menjelaskan tahapan perancangan percobaan dan metodologi ilmiah 1. Dapat menjelaskan perkembangan disiplin ilmu desain eksperimen dan implementasinya.	
1	*1. to explain basic concepts of experimental design*	*1. collection Review data for needs decision making* *2. Definition: experimental design, treatment, unit of observation, experimental unit, level, factor* *3. The concept of replication, blocking, and randomization* *4. Some examples of experimental designs in*	*Interactive lectures, Exercise exercises, discussion*	*150 minutes*	*Exercise questions, discussions*	*1. Can explain some data collection techniques for decision-making needs* *2. Can explain definitions: treatment, units of observation, experimental units, levels / level, factor, response variable (measurement)* *3. Can explain the concept of replication, blocking, and randomization*	

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		real cases in the fields of industry, agriculture, medicine *5. Some concepts of the type of treatment design, environment, and measurement (response).* *6. Stages in experimental design and scientific methodology* *7. Development of experimental design disciplines and their implementation*				*4. Can provide examples of experimental designs in real cases.* *5. Can explain several concepts of treatment design types, environment, and measurement (response).* *6. Can explain the stages of experimental design and scientific methodology* *2. Can explain the development of experimental design disciplines and their implementation.*	
2	Dapat menyususn rancangan percobaan dengan satu faktor dan rancangan acak lengkap (RAL)	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. Pengujian hipotesis nilai tengah (means models)	Ceramah interaktif, Latihan Soal, Diskusi , praktikum	150 menit	Tugas, Latihan soal, Tes, Laporan praktikum	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 menyusun pengujian hipotesis nilai tengah yang sesuai dalam rancangan satu faktor RAL dan mampu membedakan pengujian	7%/14%

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		dan model pengaruh (effect models). 5. Pengujian nilai tengah yang sederhana (uji t) 6. Ekplorasi data hasil perancangan percobaan (box-plot) 7. Pendeteksian asumsi model dan cara mengatasinya pelanggaran asumsi. 1. Perhitungan anova tanpa dan dengan menggunakan software SAS dan Minitab				hipotesis nilai tengah yang sederhana. 4. Dapat menyimpulkan hasil pengujian hipotesis	
	Be able to compile a one-factor experimental design and completely randomized design (CRD)	*1. One-factor design procedure* *2. Identify sources of diversity and compile a linear model, along with their explanations.* *3. Description and derivation of the one-factor ANOVA RAL table* *4. . Hypothesis testing of means and effect models.*	*Interactive lectures, Exercise Questions, Discussions, practicum*	*150 minutes*	*Assignments, practice questions, tests, practicum reports*	*1. Can apply a one-factor experimental design with a completely randomized design* *2. Can compile a linear model and ANOVA table one-factor design.* *3. Be able to compile a suitable mean hypothesis testing in the one-factor RAL design and be able to differentiate between simple mid-value hypothesis testing.*	*7% / 14%*

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		5. Simple middle value test (t test) *6. Exploration of experimental design data (box-plot)* *7. Detecting model assumptions and how to deal with assumption violations.* *2. ANOVA calculations without and using SAS and Minitab software*				*5. Can conclude the results of hypothesis testing*	
3	Dapat menganalisis perbandingan nilai tengah perlakuan dengan metode perbandingan berganda, dan kontras, serta penelusuran perubahan variabel respon melalui kontras polinomial orthogonal dan analisis regres	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 5. Eksplorasi data dalam perbandingan nilai tengah	Ceramah interaktif, Latihan Soal, Diskusi , praktikum	150 menit	Tugas, Latihan soal, Tes, Laporan praktikum	1. Dapat menganalisis perbandingan nilai tengah perlakuan dengan metode berbandingan 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	7%/21%

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		dan penelusuran perubahan variabel respon. 1. Perhitungan perbandingan berganda, kontras orthogonal dan kontras polinomial orthogonal tanpa dan dengan menggunakan software SAS dan Minitab					
3	*Can analyze the comparison of the mean treatment with multiple comparison methods, and contrast, and trace changes in response variables through orthogonal polynomial contrast andanalysis Multiple*	*1. Regression comparison with LSD, HSD, Duncan, Newman Keuls test, scheffe's methods* *2. Comparison of median orthogonal contrast.* *3. Tracing changes in response with orthogonal polynomial contrast.* *4. Tracking changes in response with regression analysis approach.* *5. Exploration of data in the comparison of the mean and tracing changes in response variables.*	*Interactive lectures, practice questions, discussions, practicum*	*150 minutes*	*Assignments, practice questions, tests, practicum reportsmean*	*1. Can analyze the comparison of thetreatment with multiple comparison methods* *2. Can analyze comparison of meanorthogonal contrast* *4. toCan analyze the comparison of mean values and trace changes in response variables through orthogonal polynomial contrast and regression analysis*	*7% / 21%*

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		2. Multiple comparison calculations, orthogonal contrast and orthogonal polynomial contrast without and using SAS and Minitab software					
4	Dapat menyusun rancangan percobaan dengan satu faktor dan rancangan acak kelompok lengkap (RAKL) dan rancangan acak kelompok tak lengkap	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. Menyusun pengujian yang sesuai berkaitan dengan RAKL dan rancangan acak kelompok tak lengkap 1. Perhitungan ANOVA RAKL tanpa dan dengan menggunakan software SAS dan Minitab	Ceramah interaktif, Latihan Soal, Diskusi , praktikum	150 menit	Tugas, Latihan soal, Tes, Laporan praktikum	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 menyusun pengujian hipotesis nilai tengah yang sesuai dalam rancangan satu faktor RAKL. 4. Dapat menyimpulkan hasil pengujian hipotesis	7%/28%

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4	*Can compile experimental designs with one factor and complete randomized block design (RAKL) and incomplete randomized block design*	*1. The one-factor design procedure with RAKL, including the randomization method for the treatment of the experimental unit.* *2. Construct a linear model of RAKL and decomposition of diversity sources.* *3. Creating RAKL ANOVA tables and incomplete randomized block design* *4. Arrange appropriate tests related to RAKL and incomplete* *2. randomized block design RAKL ANOVA calculations without and using SAS software and Minitab*	*Interactive lectures, Exercise Questions, Discussions, practicum*	*150 minutes*	*Assignments, Exercise questions, Tests, practicum reports*	*1. Can explain the one-factor design procedure with RAKL.* *2. Can compile linear models and ANOVA tables for one-factor RAKL design and incomplete randomized block design.* *3. Can compile a suitable median hypothesis testing in the one-factor RAKL design.* *5. Can conclude the results of hypothesis testing*	*7% / 28%*
5	Dapat menyusun rancangan percobaan dengan satu faktor dan rancangan bujur sangkar latin (RBSL)	1. Prosedur perancangan satu faktor dengan RBSL, termasuk metode pengacakan perlakuan terhadap unit eksperimen.	Ceramah interaktif, Latihan Soal, Diskusi , praktikum	150 menit	Tugas, Latihan soal, Tes, Laporan praktikum	1. Dapat menyusun prosedur perancangan satu faktor dengan RBSL. 2. Dapat menyusun model linier dan tabel anova rancangan satu faktor RBSL.	7%/35%

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		2. Menyusun model linear RBSL dan dekomposisi sumber keragaman. 3. Membuat tabel ANOVA RBSL 4. Menyusun pengujian hipotesis yang sesuai berkaitan dengan RBSL. 5. Menyusun RBSL dengan replikasi. 6. Perhitungan ANOVA RBSL dengan dan tanpa software SAS dan Minitab				3. Dapat menyusun pengujian hipotesis nilai tengah yang sesuai dalam rancangan satu faktor RBSL. 4. Dapat menyimpulkan hasil pengujian hipotesis	
5	*Can compile an experimental design with one factor and Latin square design (RBSL)*	*1. One-factor design procedure with RBSL, including the method of randomizing the treatment of the experimental unit.* *2. Constructing a linear RBSL model and decomposition of diversity sources.* *3. Creating RBSL ANOVA table*	*Interactive lectures, Exercise Questions, Discussions, practicum*	*150 minutes*	*Assignments, practice questions, tests, practicum reports*	*1. Can compile a one-factor design procedure with RBSL.* *2. Can compile linear models and ANOVA tables for one-factor RBSL designs.* *3. Can arrange a suitable mid-value hypothesis testing in the one-factor RBSL design.* *5. Can conclude the results of hypothesis testing*	*7% / 35%*

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RP-S1	Dosen Pengampu	Dr. Drs. Purhadi, M.Sc ; Dra. Wiwiek Setya Winahju, M.S. ; Dr. Sutikno, S.Si, M.Si ; Muhammad Sjahid Akbar, S.Si, M.Si

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		4. Arrange appropriate hypothesis testing related to RBSL. *5. Compile RBSL with replication.* *7. RBSL ANOVA calculations with and without SAS and Minitab software*					
6-7	Dapat menyusun rancangan percobaan dengan beberapa faktor (faktorial) dan beberapa rancangan lingkungan, serta menyusun pengujian hipotesis dengan faktor fixed, random dan mixed	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 *mean square* baik faktor fixed, faktor random, dan faktor mixed dalam tabel ANOVA.	Ceramah interaktif, Latihan Soal, Diskusi , praktikum	300 menit	Tugas, Latihan soal, Tes, Laporan praktikum	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 menjelakan konsep ekspektasi *mean square* dalam tabel ANOVA. 5. Dapat menyimpulkan hasil pengujian hipotesis	14%/49%

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6-7	*Can compile experimental designs with several factors (factorial) and several environmental designs, as well as compile hypothesis testing with fixed, random and mixed factors*	5. Membuat tabel ANOVA faktorial dengan faktor fixed, faktor random, dan faktor mixed. 6. Perhitungan ANOVA faktorial tanpa dan dengan menggunakan software SAS dan Minitab *1. Factorial design procedures, including methods of randomizing treatment to experimental units .* *2. Constructing a linear factorial model and decomposition of sources of diversity.* *3. Arrange hypothesis testing (means and variance) according to fixed factors, random factors, and mixed factors.* *4. The method of calculating theexpectations, mean*	*Interactive lectures, Exercise Questions, Discussions, practicum*	*300 minutes*	*Assignments, practice questions, tests, practicum reports*	*1.Can explain factorial design procedures with various environmental designs.* *2.Can construct linear models and ANOVA tables with factorial designs with fixed factors, random factors, and mixed factors.* *3.Can arrange a suitable mean hypothesis testing in a factorial design with fixed factors, random factors, and mixed factors.* *4.Can explain the concept ofexpectations mean square in the ANOVA table.* *6.Can conclude the results of hypothesis testing*	*14% / 49%*

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		square both fixed factors, random factors, and mixed factors, is in the ANOVA table. *5. Creating a factorial ANOVA table with fixed factors, random factors, and mixed factors.* *7. Factorial ANOVA calculations without and using SAS software and Minitab*					
	ETS/*MID TERM EXAMINATION*						
9-10	Dapat menyusun rancangan percobaan faktorial 2^k	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 .	Ceramah interaktif, Latihan Soal, Diskusi , praktikum	300 menit	Tugas, Latihan soal, Tes, Laporan praktikum	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. Dapat menyimpulkan hasil pengujian hipotesis	14%/63%

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9-10	*Can compile a 2^k*	5. Perhitungan anova faktorial 2^k tanpa dan dengan menggunakan software SAS dan Minitab *1. factorial experimental design Basic concept of 2^K experimental design and randomization procedures with various environmental designs* *2. Develop a 2^K linear modelk and decomposition of diversity sources.* *3. Create a 2^K anova table.* *4. Arrange appropriate hypothesis testing.* *6. Calculation of 2^K anova without and using SAS software and Minitab*	*Interactive lectures, practice questions, discussions, practicum*	*300 minutes*	*assignments, practice questions, tests, practicum reports*	*1. Can explain the 2^Kdesign procedure.* *2. Can compile linear model and ANOVA table 2^K design.* *3. Can arrange a suitable mid-value hypothesis testing in a factorial design.* *4. Can conclude the results of hypothesis testing*	*14% / 63%*
11	Dapat menyusun rancangan percobaan Fraksional	1. Rancangan faktorial fraksional fraksional dengan berbagai metode.	Ceramah interaktif, Latihan Soal, Diskusi	150 menit	Tugas, Latihan soal, Tes,	1. Dapat menjelaskan prosedur perancangan fraksional.	7%/70%

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Perte-muan *Meeting*	**Kemampuan Akhir Sub CP-MK** *Final Ability*	**Keluasan (materi pembelajaran)** *Extent (learning material)*	**Metode Pembelajaran** *Learning methods*	**Estimasi Waktu** *Duration*	**Bentuk Evaluasi** *Evaluation Type*	**Kriteria dan Indikator Penilaian** *Assessment Criteria and Indicators*	**Bobot Penilaian** *Scoring*
11	*Can compile a Fractional experimental design Fractional*	*2.factorial design with various methods.*	*Interactive lecture, Practice Questions, Discussion*	*150 minutes*	*Assignments, Practice questions, Tests*	*1.Can explain fractional design procedures.*	*7% / 70%*
12	Dapat menyusun rancangan percobaan *nested*	1.Prosedur perancangan percobaan nested 2.Menyusun model linear percobaan nested. 3.Menyusun tabel ANOVA rancangan nested. 4.menyusun pengujian hipotesis nilai tengah yang sesuai dalam rancangan nested 5.Perhitungan ANOVA rancangan nested tanpa dan dengan menggunakan software SAS dan Minitab	Ceramah interaktif, Latihan Soal, Diskusi , praktikum	150 menit	Tugas, Latihan soal, Tes, Laporan praktikum	1. Dapat menjelaskan prosedur perancangan percobaan nested . 2. Dapat menyusun model linier dan tabel ANOVA rancangan nested. 3. Dapat menyusun pengujian hipotesis nilai tengah yang sesuai dalam rancangan nested. 4. Dapat menyimpulkan hasil pengujian hipotesis	7%/77%
12	*Be able to compileexperimental design nested*	*1. Procedures for nested experiment design* *2. Develop a linear model for nested experiments.* *3. Construct a nested design ANOVA table.*	*Interactive lectures, Exercise questions, discussions, practicum*	*150 minutes*	*Assignments, practice questions, tests, practicum reports*	*1. Can explain the design procedures for nested experiments.* *2. Can compile linear models and ANOVA tables nested designs.*	*7% / 77%*

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		4. compile the appropriate median hypothesis testing in the nested design nested *5. ANOVA calculation design without and using SAS and Minitab software*				*3. Can compile a suitable mid-value hypothesis testing in a nested design.* *5. Can conclude the results of hypothesis testing*	
13-14	Dapat menyusun rancangan percobaan *split plot* dan perluasannya	1. Prosedur perancangan percobaan split plot. 2. Menyusun model linear percobaan split plot. 3. Menyusun tabel ANOVA rancangan split plot. 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	Ceramah interaktif, Latihan Soal, Diskusi , praktikum	300 menit	Tugas, Latihan soal, Tes, Laporan praktikum	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. 4. Dapat menyimpulkan hasil pengujian hipotesis	14%/91%
13-14	*Can compile aexperimental design*	*1. Split plot experimental design procedure.*	*Interactive lectures,*	*300 minutes*	*assignments, practice questions,*	*1.Can explain the split-plot design procedure .*	*14% / 91%*

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	split plot and its expansion	*2. Construct a linear split plot experimental model.* *3. Prepare ANOVA table for split plot design.* *4. Compile a suitable median hypothesis testing in a split plot* *6. design ANOVA calculation split design without and using SAS and Minitab software*	*practice questions, discussions, practicum*		*tests, practicum reports*	*2. Can compile linear models and ANOVA tables for split plot design.* *3. Can arrange a suitable mid-value hypothesis testing in a split plot design.* *5.Can conclude the results of hypothesis testing*	
15	Mampu mengimplementasi perancangan percobaan dalam berbagai kasus riil	Permasalahan perancangan percobaan di berbagai kasus	Kuliah Lapangan	240 menit	Tugas kelompok dan Tugas Mandiri	1.Dapat menformulasikan permasalahan riel ke dalam permasalahan perancangan percobaan. 1. Dapat mensintesa dan menganalisis permasalahan riel perancangan percobaan	9%/100%
15	*Able to implement experimental design in various real cases*	*Experimental design problems in various cases*	*Field lectures*	*240 minutes*	*Group assignments and independent assignments*	*1. Can formulate real problems into experimental design problems.* *2.Can synthesize and analyze real problems of experimental design*	*9% / 100%.*
	EAS/*FINAL EXAMINATION*						

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PUSTAKA */REFERENCES*:

1. Montgomery, D.C, 2005, Design and Analysis of EXPERIMENTALs, 6th ed. John Wiley & Sons Inc., New York.
2. Kuehl RO. 2000. Design of EXPERIMENTALs: Statistical Principles of Research Design and Analysis.
3. Box, George EP, William G Hunter & J Stuart Hunter. 1978. Staistics for EXPERIMENTALers an Introduction to Design, Data Analysis and Model Building, John Wiley & Sons., Inc.
4. Hinkelmann K, Kempthorne O.1994. Design and Analysis of EXPERIMENTALs. John Wiley &Sons. New York