INSTRUCTIONAL ANALYSIS
AND
ONE SEMESTER LEARNING PLAN

CHEMOMETRICS-LECTURE
KIM 1357 3(2-1)

By:

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INSTRUCTIONAL ANALYSIS

Learning Outcomes:
1. Able to explain and apply the subject that includes basic statistics and various chemometrics methods to produce relevant chemical information from chemical data analysis

⬆

8. Able to explain, distinguish, and use several methods of multivariate analysis in chemistry

⬆

7. Able to explain and design experiments in chemical research

⬆

6. Able to explain and understand about signals and noise

⬆

5. Able to explain differentiation, and use several non-parametric methods in chemistry

⬆

4. Able to explain differentiation, and use several calibration methods in chemistry

⬆

3. Able to explain and use various methods for determining the quality of chemical data

⬆

2. Able to explain and use basic statistics in analyzing data obtained in measurements

⬆

1. Able to explain chemometrics definitions and scope

SYLLABUS

Course/Code	:	Chemometrics /KIM 1357
Semester/scu	:	Even(Semester 6)/3(2-1)
Description of Courses	:	This course discusses the concepts and applications of statistics and mathematics for the design, evaluation and interpretation of chemical data including statistical descriptions of process quality and measurement, hypothesis testing and Analysis of variance (ANOVA), multivariate data and matrix operations, signal-noise and pre- its processing, modeling, experimental design and optimization, pattern recognition, and multivariate calibration. The scope of the discussion and learning process is to use active learning through small group discussions, cooperative learning, and assignments. The language of instruction used in this lecture is Indonesian.
Prerequisite Course	:	
Learning Outcomes	:	Able to explain and apply the given topics that includes basic statistics and various chemometrics methods to produce relevant chemical information from chemical data analysis
Division/Subject	:	Analytical Chemistry/Chemometrics
Lecturers	:	1. Rudi Heryanto, S Si, M Si 2. Prof. Dr. Mohamad Rafi, MSi

One Semester Learning Plan - Lecture

WEEK	EXPECTED FINAL ABILITY	TOPICS (TEACHING MATERIALS)	LEARNING METHODS	ASSESSMENT CRITERIA (INDICATOR)	SCORE (%)
1	2	3	4	5	6
1	Able to explain chemometrics definitions and scope	1. Introduction and learning contract 2. History, definition and the role of chemometrics in chemical experiments	Lecture, discussion	Completeness and correctness of explanations about definitions, objectives and chemometric applications.	
2,3 & 4	Able to explain and use basic	Basic Statistics	Lecture,	Completeness, correctness of	

			discussion	explanation and calculation in structuring data and constructing the form of distribution. Differentiating and calculating location parameters, dispersion, skewness kurtosis. Applying analysis of variance (Anova) in processing chemical data.	
	statistics in analysing data obtained in measurements				
5	Able to explain multivariate data and basic matrix operation	Multivariate Data and Matrix Operation	Lecture, discussion	Completeness and correctness of explanations of multivariate data and calculations in matrix algebra	
6-7	Able to explain and understand about signals and noise	Signla, Noise and Signal Preporcessing	Lecture, discussion	Completeness and correctness of explanation of signal differences with noise and simple ways to process signals	
	Mid Term Exam				**30**
8	Able to explain and understand about data modelling and curvefiting	Modelling and Curvefitting	Lecture, discussion	Completeness and correctness of explanation about simple mathematical modelling based on univariate data, and also fitting data to a mathematical model	
9-10	Able to explain and design experiments in chemical research	Introduction to experimental design	Lecture, discussion	Completeness and correctness of explanation about applying experimental design such as: Latin squares, two-way Anova and factorial design	

11	Able to explain and understand about multivariate data analysis	Introduction to multivariate analysis	Lecture, discussion	Completeness and correctness of explanation about multivariate data analysis	
12	Able to explain and understand about exploratory data analysis	Exploratory data analysis with PCA	Lecture, discussion	Completeness and correctness of explanation about exploratory data analysis using PCA	
13 & 14	Able to explain, distinguish, and use several methods of multivariate analysis in Classification and Calibration	Multivariate Analysis for Classification and Calibration	Lecture, discussion	Completeness and correctness of explanation of multivariate data analysis for classification and calibration	
	Final Term Exam				**30**

Weekly Task Design (Interactive Discussion):

Week	Assignment	Assignment Purpose	Assignment description	Assessment criteria
1-4	1	Train students to achieve final abilities for topics 1 to 4	Problem set list subject 1 to 4	Accuracy, completeness, and clarity of answers
5-7	2	Train students to achieve final abilities for topics 5 to 7	Problem set list subject 5 to 7	Accuracy, completeness, and clarity of answers
8	3	Train students to achieve final abilities for topics 8	Problem set list subject matter 8	Accuracy, completeness, and clarity of answers
9-10	4	Train students to achieve final abilities for topics 9 to 10	Problem set list subject matter 9 to 10	Accuracy, completeness, and clarity of answers
11-14	5	Train students to achieve final abilities for topics 11 to 14	Problem set list subject matter 11 to 14	Accuracy, completeness, and clarity of answers

Assessment Design:

Learning outcomes	Weekly assignments	Lecture Exams	
		Mid Term Exam	**Final Term Exam**
Capable of explain and apply the given topics including basic statistics and various methods of chemometrics to produce relevant chemical information from the analysis of chemical data	√	√	√

Weight of Evaluation:

Assessment criteria	Score range	Score weight (%)	Information
Weekly Task Assessment Small group presentations: 1. Systematics and content of presentation; 2. Timeliness of delivery; 3. Use of good language; 4. Ability to respond to questions (right or not); 5. Attitude in the delivery of material (eye contact, posture, proper attire) 6. Clarity in presentation (volume and intonation).	55-100	10	Individual score

Lecture Evaluation:
    Mid Term Exam
    Final Term Exam
	0-100
	0-100
		30
		30
			Individual score
			Individual score

Score of Chemometrics Laboratory		30	Individual score
Score of CHEMOMETRICS (KIM 1357 3(2-1))		**100**	

Weekly Task Assessment Criteria with instruments: group assessment forms and presentations

Score range	Assessment Criteria for Material Presentation
90-100	If students can present material with good systematics, timeliness of delivery, good language use, ability to answer questions properly, the attitude of delivering material is good and clear.
80-<90	If students can present material with good systematics, timeliness of delivery, good language use, ability to answer questions properly
70-<80	If students can present material with good systematics, timeliness of delivery, good language use

Recommended Reading Books Required and Supporting:

1. Brereton, R. G. 2007. *Applied Chemometrics for Scientists*, John Wiley & Sons, Ltd, Chichester, UK
2. Miller JN & Miller JC. 2010. Statistics and Chemometrics for Analytical Chemistry 6th Ed. 6. Prentice Hall

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ONE SEMESTER LEARNING PLAN

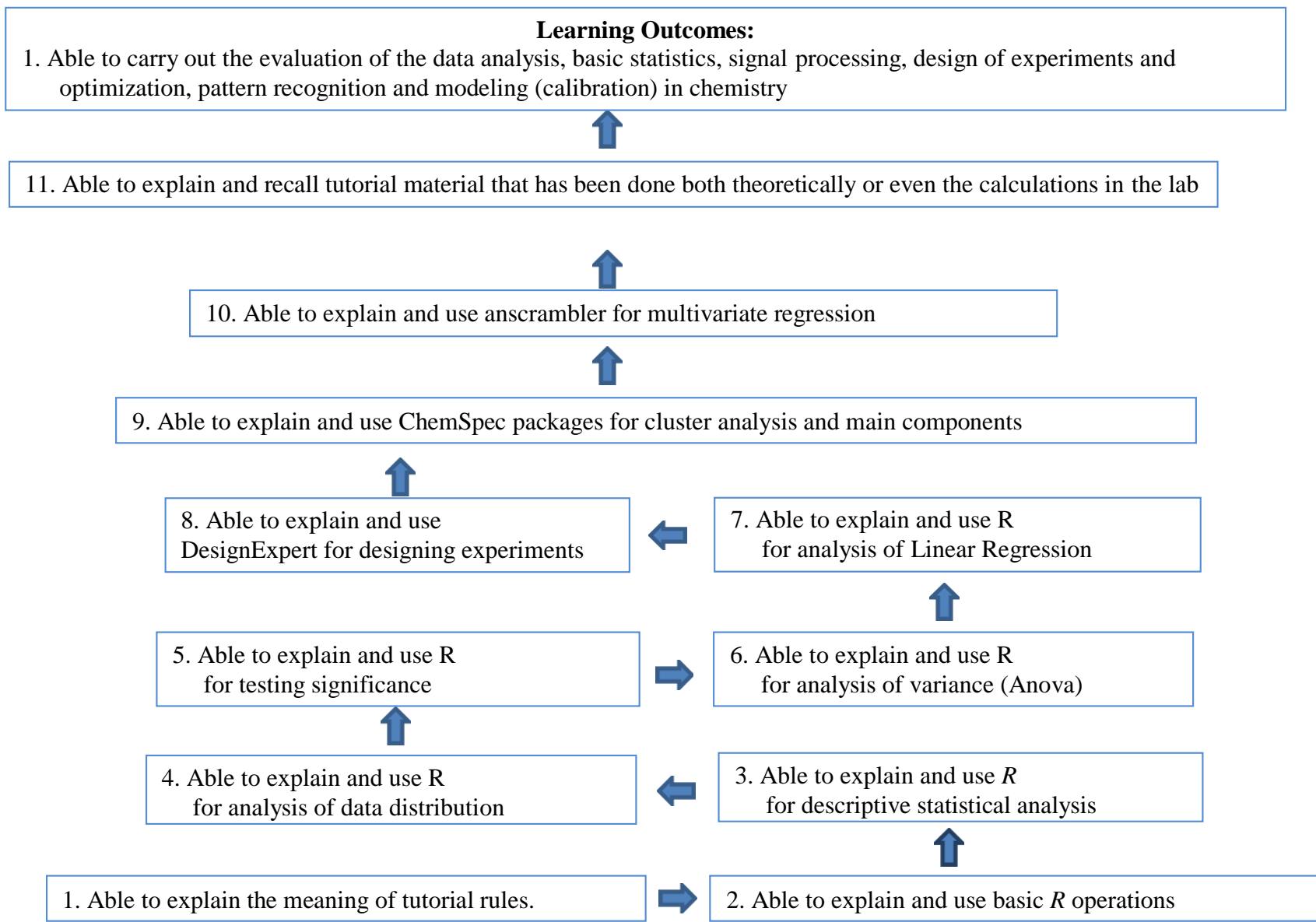# CHEMOMETRICS (TUTORIAL)
KIM 1357 3(2-1)

by:
Dr. Drs. Muhamad Farid Sidik, M.Si
Luthfan Irfana S.Si, M.Si
Zulhan Arif, SSi, MSi

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INSTRUCTIONAL ANALYSIS

Learning Outcomes:
1. Able to carry out the evaluation of the data analysis, basic statistics, signal processing, design of experiments and optimization, pattern recognition and modeling (calibration) in chemistry

⬆

11. Able to explain and recall tutorial material that has been done both theoretically or even the calculations in the lab

⬆

10. Able to explain and use anscrambler for multivariate regression

⬆

9. Able to explain and use ChemSpec packages for cluster analysis and main components

⬆

8. Able to explain and use DesignExpert for designing experiments	⬅	7. Able to explain and use R for analysis of Linear Regression

⬆ (for box 7)

5. Able to explain and use R for testing significance	➡	6. Able to explain and use R for analysis of variance (Anova)

⬆ (for box 5)

4. Able to explain and use R for analysis of data distribution	⬅	3. Able to explain and use R for descriptive statistical analysis

⬆ (for box 3)

1. Able to explain the meaning of tutorial rules.	➡	2. Able to explain and use basic R operations

SYLLABUS

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Description of Courses	:	This course discusses the concepts and applications of statistics and mathematics for the design, evaluation and interpretation of chemical data including statistical descriptions of process quality and measurement, hypothesis testing and Analysis of variance (ANOVA), multivariate data and matrix operations, signal-noise and pre- its processing, modeling, experimental design and optimization, pattern recognition, and multivariate calibration. The scope of the discussion and learning process is to use active learning through small group discussions, cooperative learning, and assignments. The language of instruction used in this lecture is Indonesian..
Prerequisite Course	:	
Learning Outcomes (LO) Courses	:	Able to carry out the evaluation of the data analysis, basic statistics, signal processing, design of experiments and optimization, pattern recognition and modeling (calibration) in chemistry
Division/Subject	:	Analytical Chemistry/Chemometrics
Lecturers	:	1. Dr. Drs. Muhamad Farid Sidik, M.Si 2. Luthfan Irfana S.Si, M.Si 3. Zulhan Arif, SSi, MSi

One Semester Learning Plan (OSLP) Lectures:

WEEK	EXPECTED FINAL ABILITY	TOPICS	LEARNING METHODS	ASSESSMENT CRITERIA (INDICATOR)	WEIGHT SCORE
1	**2**	**3**	**4**	**5**	**6**
1	Able to explain the meaning of tutorial rules.	Introduction to Tutorial: - Regulations, computer laboratory regulations, - Explanation on report, assessment and replacement of tutorial	Lecture, discussion	Completeness and correctness of explanation on tutorial regulations	
2 & 3	Able to explain and use basic R operations	Introduction to Software R	Explanation, and computer assisted tutorial	Completeness and correctness of explanation about basics of R command using the Chemometrics package with R and Chemospec	
4	Able to explain and use R for descriptive statistical analysis	Descriptive Statistics with R	Explanation, and computer assisted tutorial	Completeness and truth of explanation about applying the command statistics is descriptive in R; Perform data analysis simulations	
5	Able to explain and use R for analysis of data distribution	Probability and Normal Distribution with R	Explanation, and computer assisted tutorial	Completeness and correctness of explanation about operating command commands analyse data distribution and plot graphs in R Perform data analysis simulations	
6	Able to explain and use R for testing significance	Significance Test with R	Explanation, and computer assisted tutorial	Completeness and correctness of explanation about operating command analysis commands is significant in $R;$ Perform data analysis simulations	
7	Able to explain and use R	Variance Analysis with R	Explanation, and	Completeness and correctness of	

			computer assisted tutorial	explanation about command analysis variant in R and perform data analysis simulations	
8	Able to explain and use R for analysis of Linear Regression	Linear Regression Analysis with R	Explanation, and computer assisted tutorial	Completeness and correctness of explanation about operating command commands linear regression analysis in R; Perform data analysis simulations	
9 & 10	Able to explain and use DesignExpert for designing experiments	Design and Analysis Experiments with DesignExpert	Explanation, and computer assisted tutorial	Completeness and correctness of explanation about using the DesignExpert software; Perform design simulation and experimental analysis	
11 & 12	Able to explain and use ChemSpec packages for cluster analysis and main components	Cluster Analysis and Main Components with ChemSpec in R	Explanation, and computer assisted tutorial	Completeness and truth about Using ChemSpec in R. Perform data simulation and cluster analysis and main components	
13	Able to explain and use unscramble for multivariate regression	Multivariate regression with Uncrambler	Explanation, and computer assisted tutorial	Completeness and correctness of explanation about using Unscrambler. Perform data simulation and multivariate regression analysis	
14	Able to explain and recall tutorial material that has been done both theoretically or the calculations in the tutorial class	Tutorial Evaluation	Explanation and computer assisted tutorial	Completeness and correctness of the explanation about applying the tutorial material that has been given	
	EXAM				**30**

Weekly Task Design (Interactive Discussion):

Week	Assignment	Assignment Purpose	Assignment description	Assessment criteria
1-4	1	Train students to achieve final	Problem set list subject 1 to 4	Accuracy, completeness an,d

		abilities subject matter 1 to 4		clarity of answers
5-7	2	Train students to achieve final abilities subject matter 5 to 7	Problem set list subject 5 to 7	Accuracy, completeness, and clarity of answers
8-11	3	Train students to achieve final abilities subject matter 8 to 11	Problem set list subject matter 9 to 11	Accuracy, completeness, and clarity of answers
12-14	4	Train students to achieve final abilities subject matter 12 to 15	Problem set list subject matter 12 to 15	Accuracy, completeness, and clarity of answers

Evaluation Design:

Learning outcomes	Weekly Reports	Exam
Able to evaluate analysis of data, basic statistics, signal processing, experimental design and optimization, pattern recognition, and modelling (calibration) in chemistry	√	√

Weightage of Evaluation:

Assessment criteria	Score range	Score Weight (%)	Information
Weekly Task Assessment Small group presentations: 1. Systematics and content of presentation; 2. Timeliness of delivery; 3. Use of good language; 4. Ability to respond to questions (right or not); 5. Attitude in the delivery of material (eye contact, posture, proper attire) 6. Clarity in presentation (volume and intonation).	55-100	10	Individual score

Tutorial Evaluation:
    Tutorial Report
    Exam
	0-100
	0-100
		40
		40
			Individual score
			Individual score

Score for CHEMOMETRIC-TUTORIAL (KIM 1357 3(2-1))		**100**	

Weekly Task Assessment Criteria with instruments: group assessment forms and presentations

Score range	Assessment Criteria for Material Presentation
90-100	If students can present material with good systematics, timeliness of delivery, good language use, ability to answer questions properly, the attitude of delivering material is good and clear.
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Recommended reading books:

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