TEACHING-LEARNING CONTRACT
LEARNING PROGRAM OUTLINE
LEARNING UNIT PROGRAM

DESIGN OF EXPERIMENTS
PAS 125

STATISTICS STUDY PROGRAM OF MATHEMATICS DEPARTMENT
MATHEMATICS AND SCIENCE FACULTY
DIPONEGORO UNIVERSITY
SEMARANG
2007
TEACHING – LEARNING CONTRACT

Course Title: Design of Experiments
Code: PAS 125
Credit: 3
Semester: 5

1. Course Advantage
This course is an applied statistics in research. Very useful to analyse a research at industrial, health, biological, agriculture, education area and the other area which need a research of attempt.

2. Course Description
This course have important of treatment design, respon design and design of environment for one factor and two factor design. One factor design cover randomized design (RD), randomized block design (RBD), Latin Square design. We will study to estimate parameter model, tables of anova, comparing means treatment, adequacy checking (homogenity and normality of residual). Two factor design studied about factorial, and split plot design.

3. General Instructional Aim
After attend the lecture this student expected can chosen design matching with the problem of faced, analyse, checking model and conclude result of analysis.

4. Lecture Strategic.
To reach the target of this course this study system use two way teaching methods, that are lecturing and discussing. To increase the activity of student are given some assignation in the form of quiz in the class, and task that self done at home. This course is also performed by praktikum with program package are SAS 6.12 and minitab 13.
5. References


Criteria of scoring in this course is:

<table>
<thead>
<tr>
<th>Scoring</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>4.0</td>
</tr>
<tr>
<td>AB</td>
<td>3.5</td>
</tr>
<tr>
<td>B</td>
<td>3.0</td>
</tr>
<tr>
<td>BC</td>
<td>2.5</td>
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<tr>
<td>C</td>
<td>2.0</td>
</tr>
<tr>
<td>CD</td>
<td>1.5</td>
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<td>D</td>
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<td>DE</td>
<td>0.5</td>
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<tr>
<td>E</td>
<td>0.0</td>
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</table>

Determination of scoring criteria is used weighted such as:

<table>
<thead>
<tr>
<th>No</th>
<th>Component</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Quiz</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>Self-done task</td>
<td>15</td>
</tr>
<tr>
<td>3</td>
<td>Praktikum</td>
<td>15</td>
</tr>
<tr>
<td>4</td>
<td>Midterm</td>
<td>25</td>
</tr>
<tr>
<td>5</td>
<td>Final exam</td>
<td>35</td>
</tr>
</tbody>
</table>
## 7. Lecture Schedule

<table>
<thead>
<tr>
<th>week</th>
<th>Material</th>
<th>references</th>
</tr>
</thead>
</table>
| 1    | 1. Teaching-learning contract  
2. Introduction  
3. Elementary principle of design experiments | [1]: 1-21  
[2]: 1-22  
[3]: 149-167  
[4]: modul 1 |
| 2    | Randomized design with is same number of observation, its analysis, comparing means, and adequacy checking. | [1]: 61-73 ; 76-108  
[2]: 62-76; 97-111; 115-140  
[3]: 168-178  
[4]: modul 2 and 3 |
| 3    | Randomized design with is unbalance data, its analysis, comparing means, and adequacy checking. | [1]: 75-108  
[2]: 77-80 ; 115-140  
[3]: 179-182  
[4]: modul 2 and 3 |
| 4    | Randomized block design cover its analysis, comparing means, and adequacy checking. | [1]: 119-133  
[2]: 198-209  
[3]: 236-253  
[4]: modul 3 and 4 |
| 5    | Efisiensi relative, missing data for randomized block design. | [1]: 130-133  
[2]: 209-217  
[4]: modul 4 |
| 6    | Latin square design cover its analysis, comparing means, and adequacy checking. | [1]: 136-142  
[2]: 231-260  
[3]: 267-283  
[4]: modul 5 and 3 |
| 7    | Efisiensi relative, missing data for latin square design | [1]: 136-142  
[2]: 231-260  
[3]: 267-283  
[4]: modul 5 |
| 8    | Midterm | - |
| 9    | Praktikum 1 | [5]: Modul praktikum |
| 10, 11 | Two factor factorial design | [1]: 160-197  
[2]: 317-395  
[3]: 403-450  
[4]: modul 6 |
| 12   | Praktikum 2 | [5]: Modul praktikum |
| 13, 14 | Split plot design | [2]: 370-390  
[3]: 451-470  
[4]: modul 7 |
| 15   | Praktikum 3 | [5]: Modul praktikum |
| 16   | Final exam | - |
LEARNING PROGRAM OUTLINE

Course Title: Design of Experiments
Code: PAS 125
Credit: 3
Semester: 5

1. Course Description
This course have important of treatment design, respond design and design of environment for one factor and two factor design. One factor design cover randomized design (RD), randomized block design (RBD), Latin Square design. We will study to estimate parameter model, tables of anova, comparing means treatment, adequacy checking (homogeneity and normality of residual). Two factor design studied about factorial, and split plot design.

2. General Instructional Aim
After attend the lecture this student expected can chosen design matching with the problem of faced, analyse, checking model and conclude result of analysis.

<table>
<thead>
<tr>
<th>No</th>
<th>Specific Instructional Aim</th>
<th>Subject</th>
<th>Sub Subject</th>
<th>duration</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The students can to mention the aim, advantage and process of studying.</td>
<td>Teaching learning contract</td>
<td>General instructional aim, Relevance this course to another course, Evaluation and scoring criteria</td>
<td>1x50 minutes</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>Student can know importantly design of experiments of attempt in research.</td>
<td>Design of Experiments</td>
<td>Introduction, Principle of Design of Experiments</td>
<td>2x50 minutes</td>
<td>[1]:1-21 [2]:1-22 [3]:149-167 [4]:modul 1</td>
</tr>
<tr>
<td>3</td>
<td>Students can compile anova table, comparing test of means, adequacy checking, giving node result of analysis for RD (randomized design).</td>
<td>Randomized design</td>
<td>Usage of RD (Randomized Design), fixed and random model, balanced and unbalanced data, comparing means, coefficient of variation, homogeneity and normality of residual.</td>
<td>6x50 minutes</td>
<td>[1]:61-112 [2]:62-114 [3]:168-201 [4]:modul 2 and 3</td>
</tr>
<tr>
<td>4</td>
<td>Students can compile anova table, Randomized</td>
<td>Block Design</td>
<td>Usage of RBD, its manner analysis,</td>
<td>6x50 minutes</td>
<td>[1]:119-135 [2]:198-230</td>
</tr>
<tr>
<td></td>
<td>Student can compile anova table, comparing test of means, adequacy checking, giving node result of analysis for split plot design.</td>
<td>Split plot Design</td>
<td>Split plot in RD</td>
<td>6x50 minutes</td>
<td>[2]: 370-390</td>
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</tr>
<tr>
<td>7</td>
<td>Students can compile anova table, comparing test of means, adequacy checking, giving node result of analysis for split plot design.</td>
<td>Factorial Design</td>
<td>Principle two factor factorial design, Factorial in RD, Factorial in RBD</td>
<td>6x50 minutes</td>
<td>[1]: 160-197</td>
</tr>
<tr>
<td>6</td>
<td>Students can compile anova table, comparing test of means, adequacy checking, giving node result of analysis for two factor factorial design.</td>
<td>Factorial Design</td>
<td>Principle two factor factorial design, Factorial in RD, Factorial in RBD</td>
<td>6x50 minutes</td>
<td>[1]: 160-197</td>
</tr>
<tr>
<td>5</td>
<td>Students can compile anova table, comparing test of means, adequacy checking, giving node result of analysis for latin square design.</td>
<td>Latin Square Design</td>
<td>Usage of latin square design, its manner analysis, homogeneity and normality of residual, comparing means, coefficient of variation, relative efficiency, missing data.</td>
<td>6x50 minutes</td>
<td>[1]: 136-142</td>
</tr>
<tr>
<td>4</td>
<td>comparing test of means, adequacy checking, giving node result of analysis for randomized block design (RBD).</td>
<td>(RBD)</td>
<td>homogeneity and normality of residual, comparing means, coefficient of variation, relative efficiency, missing data.</td>
<td></td>
<td>[3]: 236-264</td>
</tr>
<tr>
<td>5</td>
<td>Tatik Widiarih (2007). Modul Praktikum Rancangan Percobaan. Laboratorium Matematika FMIPA UNDIP</td>
<td></td>
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</tr>
</tbody>
</table>
LEARNING UNIT PROGRAM

Course Title: Design of Experiments
Code: PAS 125
Credit: 3
Duration: 150 minutes
Week: 1

A. INSTRUCTIONAL AIM

1. General: After attend the lecture this student expected can chosen design matching with the problem of faced, analyse, checking model and conclude result of analysis.

2. Specific: Student can know importantly design of experiments of attempt in research.

B. SUBJECT: Design of Experiments
C. SUB SUBJECT: 1. Introduction
2. Principle of design of experiments

D. TEACHING-LEARNING ACTIVITIES

<table>
<thead>
<tr>
<th>STAGE</th>
<th>LECTURER ACTIVITIES</th>
<th>STUDENTS ACTIVITIES</th>
<th>LEARNING MEDIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTRODUCTION</td>
<td>1. Submitting teaching-learning contract</td>
<td>Observing and taking notes</td>
<td>OHP, transparency White board</td>
</tr>
<tr>
<td></td>
<td>2. Explaining relevance this course with the other course</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Explaining general aim</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PRESENTATION</td>
<td>1. Explaining principle design of experiment</td>
<td>Observing, asking, taking notes, doing task</td>
<td>OHP, transparency White board.</td>
</tr>
<tr>
<td></td>
<td>2. Explaining how to choose a design.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Giving the example of applying and give task.</td>
<td></td>
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</tr>
<tr>
<td>CLOSING</td>
<td>1. Giving comment to work student.</td>
<td>Answering to, discussion</td>
<td>White board</td>
</tr>
<tr>
<td></td>
<td>2. Giving task to be done at home</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3. Describing material at week 2.

E. ASSESSMENT: Giving problem to the students..

F. REFERENCES:


LEARNING UNIT PROGRAM

Course Title : Design of Experiments
Code : PAS 125
Credit : 3
Duration : 6x50 minutes
Week : 2, 3

A. INSTRUCTIONAL AIM

1. General : After attend the lecture this student expected can chosen design matching with the problem of faced, analyse, checking model and conclude result of analysis.

2. Specific : Students can compile anova table, comparing test of means, adequacy checking, giving node result of analysis for RD (randomized design).

B. SUBJECT : Randomized Design (RD)

C. SUB SUBJECT : 1. Usage of RD (Randomized Design)

2. Fixed and random model

3. Balanced and unbalanced data

4. Comparing means

5. Coefficient of variation.

6. Homogeneity and normality of residual,

D. TEACHING-LEARNING ACTIVITIES

<table>
<thead>
<tr>
<th>STAGE</th>
<th>LECTURER ACTIVITIES</th>
<th>STUDENTS ACTIVITIES</th>
<th>LEARNING MEDIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTRODUCTION</td>
<td>1. Giving opportunity to student to ask previous items which not yet been mastered</td>
<td>Observing and taking notes</td>
<td>OHP, transparancy, White board</td>
</tr>
<tr>
<td></td>
<td>2. Explaining relevance this section with previous section</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Explaining the material for this</td>
<td></td>
<td></td>
</tr>
<tr>
<td>section</td>
<td>Explaining randomized design about: linear model, data layout, anova, comparing means, adequacy checking, coefficient of variation, follow the example of applying and give task.</td>
<td>Observing, asking, taking notes, doing task</td>
<td>OHP, transparency White board.</td>
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</tr>
</tbody>
</table>
| CLOSING      | 1. Giving comment to work student.  
               2. Giving task to be done at home  
               3. Describing material at next week | Answering to, discussion | White board |

E. ASSESSMENT: Giving problem to the students.

F. REFERENCES:


LEARNING UNIT PROGRAM

Course Title: Design of Experiments
Code: PAS 125
Credit: 3
Duration: 6 x 50 minutes
Week: 4, 5

A. INSTRUCTIONAL AIM

1. General: After attend the lecture this student expected can chosen design matching with the problem of faced, analyse, checking model and conclude result of analysis..

2. Specific: Students can compile anova table, comparing test of means, adequacy checking, giving node result of analysis for randomized block design (RBD).

B. SUBJECT: Randomized Block Design (RBD)

C. SUB SUBJECT: 1. Usage of RBD

2. Anova Table

3. Homogeneity and normality of residual,

4. Comparing means treatment

5. Coefficient of variation, relative efficiency,

6. Missing data in RBD

D. TEACHING-LEARNING ACTIVITIES

<table>
<thead>
<tr>
<th>STAGE</th>
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<th>STUDENTS ACTIVITIES</th>
<th>LEARNING MEDIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTRODUCTION</td>
<td>1. Giving opportunity to student to ask previous items which not yet been mastered</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Explaining relevance this section with previous section</td>
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<tr>
<td></td>
<td>3. Explaining the material for this</td>
<td>Observing and taking notes</td>
<td>OHP, transparency White board</td>
</tr>
<tr>
<td>section</td>
<td>Observing, asking, taking notes, doing task</td>
<td>OHP, transparancy White board</td>
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</tr>
<tr>
<td>PRESENTATION</td>
<td>Explaining randomized block design (RBD) about: linear model, data layout, anova, comparing means, adequacy checking, coefficient of variation, relative efficiency, missing data, follow the example of applying and give task.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CLOSING</td>
<td>1. Giving comment to work student. 2. Giving task to be done at home 3. Describing material at next week</td>
<td>Answering to discussion</td>
<td>White board</td>
</tr>
</tbody>
</table>

E. ASSESSMENT: Giving problem to the students.

F. REFERENCES:


LEARNING UNIT PROGRAM

Course Title : Design of Experiments
Code : PAS 125
Credit : 3
Duration : 6x50 minutes
Week : 6,7

A. INSTRUCTIONAL AIM

1. General : After attend the lecture this student expected can chosen design matching with the problem of faced, analyse, checking model and conclude result of analysis.

2. Specific : Students can compile anova table, comparing test of means, adequacy checking, giving node result of analysis for latin square design.

B. SUBJECT : Latin Square Design

C. SUB SUBJECT : 1. Usage of Latin Square Design

2. Anova Table

3. Homogeneity and normality of residual

4. Comparing means treatment

5. Coefficient of variation, relative efficiency,

6. Missing data in Latin Square Design

D. TEACHING-LEARNING ACTIVITIES

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<tr>
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<tbody>
<tr>
<td>INTRODUCTION</td>
<td>1. Giving opportunity to student to ask previous items which not yet been mastered</td>
<td>Observing and taking notes</td>
<td>OHP, transparancy White board</td>
</tr>
<tr>
<td></td>
<td>2. Explaining relevance this section with previous section</td>
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<tr>
<td></td>
<td>3. Explaining the material for this section</td>
<td></td>
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<tr>
<td>PRESENTATION</td>
<td>Explaining Latin Square design about: linear model, data layout, anova, comparing means, adequacy checking, coefficient of variation, relative efficiency, missing data, follow the example of applying and give task.</td>
<td>Observing, asking, taking notes, doing task</td>
<td>OHP, transparency White board.</td>
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</tr>
</tbody>
</table>
| CLOSING      | 1. Giving comment to work student.  
2. Giving task to be done at home  
3. Describing material at next week | Answering to discussion | White board |

E. ASSESSMENT: Giving problem to the students.

F. REFERENCES:


LEARNING UNIT PROGRAM

Course Title : Design of Experiments
Code : PAS 125
Credit : 3
Duration : 6x120 minutes
Week : 9,12,15

A. INSTRUCTIONAL AIM

1. General : After attend the lecture this student expected can chosen design matching with the problem of faced, analyse, checking model and conclude result of analysis..

2. Specific : After following this praktikum [of] student can use package of SAS 6.12 and minitab 13 to: making program, reading output and give node of done analysis.

B. SUBJECT : Praktikum

C. SUB SUBJECT : 1. Randomized Design
2. Randomized Block Design
3. Latin Square Design
4. Two Factor Factorial Design
5. Split plot Design

D. TEACHING-LEARNING ACTIVITIES

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<tr>
<th>STAGE</th>
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<tbody>
<tr>
<td>INTRODUCTION</td>
<td>1. Submitting teaching-learning contract</td>
<td>Observing and taking notes</td>
<td>OHP, transparancy</td>
</tr>
<tr>
<td></td>
<td>2. Explaining relevance this course with the other course</td>
<td></td>
<td>White board</td>
</tr>
<tr>
<td></td>
<td>3. Explaining general aim</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PRESENTATION</td>
<td>1. Explaining principle of package SAS 6.12 and minitab</td>
<td>Observing, asking, taking notes, doing task</td>
<td>OHP, transparancy</td>
</tr>
<tr>
<td></td>
<td>2. Explaining GLM procedur for the :</td>
<td></td>
<td>White board.</td>
</tr>
</tbody>
</table>


contrast of, anova, comparing means, adequacy checking, output and this analysis.

| CLOSING                  | 1. Giving comment to work student.  
|                         | 2. Giving task to be done at home  
|                         | 3. Describing material at next week |
| Answering to, discussion | White board                      |

E. ASSESSMENT : Giving problem to the students..

F. REFERENCES:

   Volume I. SAS Institute Inc. SAS Campus Drive. Cary, NC.27513. USA

2. --------------. 1997 Experimental Design for Researchers, Department of  
   Statistics, Faculty of Information and Mathematical Science, Massey University, Australian.

   Laboratorium Matematika, FMIPA Undip.

LEARNING UNIT PROGRAM

Course Title: Design of Experiments
Code: PAS 125
Credit: 3
Duration: 6x50 minutes
Week: 10,11

A. INSTRUCTIONAL AIM

1. General: After attend the lecture this student expected can chosen design matching with the problem of faced, analyse, checking model and conclude result of analysis.

2. Specific: Students can compile anova table, comparing test of means, adequacy checking, giving node result of analysis for two factor factorial design.

B. SUBJECT: Factorial Design

C. SUB SUBJECT: 1. Principle two factor factorial design
2. Factorial in RD.
3. Factorial in RBD.

D. TEACHING-LEARNING ACTIVITIES

<table>
<thead>
<tr>
<th>STAGE</th>
<th>LECTURER ACTIVITIES</th>
<th>STUDENTS ACTIVITIES</th>
<th>LEARNING MEDIA</th>
</tr>
</thead>
</table>
| INTRODUCTION    | 1. Giving opportunity to student to ask previous items which not yet been mastered  
2. Explaining relevance this section with previous section 
3. Explaining the material for this section | Observing and taking notes   | OHP, transparancy White board |
<p>| PRESENTATION    | Explaining factorial design, two factor factorial design about: linear model, data | Observing, asking, taking notes, doing task | OHP, transparancy White board |</p>
<table>
<thead>
<tr>
<th>CLOSING</th>
<th>Answering to discussion</th>
<th>White board</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Giving comment to work student.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Giving task to be done at home</td>
<td></td>
<td></td>
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<tr>
<td>3. Describing material at next week</td>
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</table>

E. ASSESSMENT: Giving problem to the students.

F. REFERENCES:


LEARNING UNIT PROGRAM

Course Title: Design of Experiments
Code: PAS 125
Credit: 3
Duration: 6x50 minutes
Week: 13,14

A. INSTRUCTIONAL AIM

1. General: After attend the lecture this student expected can chosen design matching with the problem of faced, analyse, checking model and conclude result of analysis.

2. Specific: Students can compile anova table, comparing test of means, adequacy checking, giving node result of analysis for split plot design.

B. SUBJECT: Split plot Design
C. SUB SUBJECT: 1. Split plot in RD
2. Split plot in RBD

D. TEACHING-LEARNING ACTIVITIES

<table>
<thead>
<tr>
<th>STAGE</th>
<th>LECTURER ACTIVITIES</th>
<th>STUDENTS ACTIVITIES</th>
<th>LEARNING MEDIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTRODUCTION</td>
<td>1. Giving opportunity to student to ask previous items which not yet been mastered</td>
<td>Observing and taking notes</td>
<td>OHP, transparency White board</td>
</tr>
<tr>
<td></td>
<td>2. Explaining relevance this section with previous section</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Explaining the material for this section</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PRESENTATION</td>
<td>Explaining split plot design about: linear model, data layout, anova, comparing</td>
<td>Observing, asking, taking notes, doing task</td>
<td>OHP, transparency White board</td>
</tr>
</tbody>
</table>
means, adequacy checking, follow the example of applying and give task

| CLOSING  | 1. Giving comment to work student.  
|          | 2. Giving task to be done at home   
|          | 3. Describing material for final exam | Answering to, discussion | White board |

E. ASSESSMENT: Giving problem to the students.

F. REFERENCES:


