# MATHEMATICAL STATISTICS I

**COURSE CODE: PAS 206**

**3 SCU**

**SEMESTER III**

**BY:**

UPT-PUSTAK-UNDIP
No. Daft: 0092/BA/FMIPA/09
Tgl. : 17-6-'09

**STATISTICS STUDY PROGRAM**
**MATHEMATICS AND NATURAL SCIENCES FACULTY**
**DIPONEGORO UNIVERSITY**
**SEMARANG**

| | |
|---|---|
| **COURSE NAME** | **: MATHEMATICAL STATISTICS I** |
| **COURSE CODE** | **: PAS 206** |
| **SCU** | **: 3** |
| **SEMESTER** | **: III** |

## I. Objective and Advantage of Course

In statistics needed theory and practice course. For that basic teorities must be mathematical statistics I which is a course about statistics explained by mathematical. This course objectives as basics of learning method, definitions, study and analyze advanced statistics method. So this course used to observe good statistics with both theory and practice. In lecture will be given by theory and practice. Then the students expected able to absorb that good material and apply it to self develop on future times.

## II. Course Description

This course is grand course on semester III. The materials of course are Probability Theory, Random Variable and It distribution, Random Variable Transformation and Expected Value, Decrete Probability Distributions, Continuous Distributions, Bivariat Distributions and Random Variable Function Distributions, and Central Limit Theorem. These materials hoped use to aid problem solving in advanced statistics both study and daily life.

## III. Instructional Objective

**General Instructional Objective:**

After attend this course the students hoped could know basic of theory statistics by mathematical and use it as foundation to build advanced statistics and able to solve statistics problem in daily life.

**Special Instructional Objectives:**

After follow this course, the students hoped could:

1. Define and use probability theory.
2. Define and difference both descrete and random variable, determine density function and it distributions.
3. Do random variable transformation, determine expected value and moment generator function.
4. Explain and apply descrete distributions.
5. Commen back ground and history of gamma distribution, exponential and chi-square distributions.
6. Verify normal distribution properties and able to difference distribution parameter types.
7. Define bivariat random variable and verify independent random variables.
8. Explain meaning of statistics and random sample.
9. Apply continuous bivariat transformation and beta distributions.
10. Use t and F distributions.
11. Use moment generating function technics to look for mean and stadard deviation distributions.
12. Apply the central limit theorem.

## IV. Lecture Strategic

Lecture method use presentation with solve problem, task and practice. Presentation done by lecture modul. Solve problem done to absorb material well, whereas the task is given by scheduled on last lecture for the subject. The task has been given, collected on meeting other time, that result wil be retuned to students for correction themselves. Well, other time done discussion about the task. The students hoped talk active in lecture or discussion, so they could absorb that material by good and true. Other thing to know by practically done by practise and so by computation can make program and see relevan software. General aims, in order to students see by theory and counting. Then on other time used to add capable building themselves by theory and practice at science forum so on.

## V. References

The text books in this lecture are:


1. Bain L.J., *Introduction to Probability and Mathematical Statistics*, Second Edition, Duxbury Press, Belmont California, 1991.
2. Casella and Berger, *Statistics Inference*, Brooks/Cole Publishing Company, California, 1990.
3. Hogg, R.V. and Craig, A.T., *Introduction to Mathematical Statistics*, Fifth Edition, Prentice-Hall, Inc., New Jersey, 1995.


## VI. Task and Practice

The task was given by:

**Task I** is given with individual, after first a half of material had been studied. Task submiting was done on tomorrow meeting. **Task result I** had been corrected will be return to students as feed back about material absorbing.

**Tasl II** is given with individual, after last a half of material had been studied. Task submitting was done on tomorrow meeting. **Task result II** had been corrected will be return to students as feed back about material absorbing.

The practice was given by:

The practice was done in Statistics Laboratory with present 5 times and 1 time to use response. The other hand, students must make practice result report by individual as practice complete conditional.

## VII. Scoring Criteria

Scoring will be done by lecturer with use condition as follow:

| | | |
|---|---|---|
| **A** | 4 | $87,5 < x \leq 100$ |
| **AB** | 3,5 | $75 < x \leq 87,5$ |
| **B** | 3 | $62,5 < x \leq 75$ |
| **BC** | 2,5 | $50 < x \leq 62,5$ |

| | | |
|---|---|---|
| **C** | 2 | $37,5 < x \leq 50$ |
| **CD** | 1,5 | $25 < x \leq 37,5$ |
| **D** | 1 | $12,5 < x \leq 25$ |
| **E** | 0 | $0 < x \leq 12,5$ |

On determine final grade would be used weighted as follow:

| | | |
|---|---|---|
| Task | : | 10 % |
| Practice | : | 20 % |
| Midsemester Exam | : | 35 % |
| Semester Final Exam | : | 35 % |

## VIII. Meeting Schedule

| | | |
|---|---|---|
| 1 | 1. Lecture Contract<br>2. Introduction of Probability<br>3. Combinatorics | [1], and [2] |
| 2 | 4. Conditional Probability<br>5. Independent Event and Bayes Theorem | [1], and [2] |
| 3 | 6. Random Variables<br>7. Descrete and Continuous Probability Distributions | [1], [2], and [3] |
| 4 | 8. Univariate Transformation<br>9. Task I | [1], [2], and [3] |
| 5 | 10. Jacobian Transformation and Expected Value<br>11. Moment Generating Functions<br>12. Problem Solving | [1] and [2] |

| | | |
|---|---|---|
| 6 | 13. Binomial Distribution<br>14. Hipergeometric Distribution | [1] and [2] |
| 7 | 15. Geometric and Poisson Distributions<br>16. Uniform and Negative Binomial<br>17. Problem Solving | [1] and [2] |
| | | |
| 9 | 18. Gamma Distribution<br>19. Chi-square Distribution | [1], [2], and [3] |
| 10 | 20. Normal Distribution | [1], [2], and [3] |
| 11 | 21. Bivariat Distribution<br>22. Independent Random Variables<br>23. Problem Solving | [1], and [3] |
| 12 | 24. Sampling Theory<br>25. Bivariate Transformations<br>26. Task II | [3] |
| 13 | 27. Beta Distribution<br>28. Student and F Distributions | [3] |
| 14 | 29. Moment Generating Function Technic | [1] and [3] |
| 15 | 30. Mean and S Distribution<br>31. Central Limit Theorem | [3] |
| 16 | 32. Task Discussing<br>33. Problem Solving | Modul |
| | | |

**COURSE** : **MATHEMATICAL STATISTICS I**

**CODE / SCU** : **PAS 206 / 3**

**SHORT DESCRIPTION :**

This course is grand course given in semester III. The objective is basic study to learn statistics by use mathematical. In order students could absorb statistics both theory and practice with well. The materials content about Probability Theory, Random Variable and It distributions, Random Variable Transformation and Expected Value, Descrete Probability Distribution, Continuous Probability Distribution, Bivariate Distribution and Random Variable Function Distribution, and then Central Limit Theorem. These materials hoped to use for help problem solving arise on advanced statistics as lecture as daily life.

**GENERAL INSTRUCTIONAL OBJECTIVES:**

After follow this course, the students hoped could know basic theory of statistics by mathematical and apply it as foundation for develop advanced course and able to solve statistics problems in daily life.

| Nu. | Spefific Instructional Objectives | Suject Core | Sub Subject Core | Est. Time | References |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 |
| 1. | Students see this lecture contract and probability definition | Lecture Contract Expected Value | a. Lecture Contract<br>b. Probility and Combinatorics | 150 | [1], and [2] |
| 2. | Students able to talk about independent events | Independent Events | a. Independent Event<br>b. Bayes Theorem | 150 | [1], and [2] |
| 3. | Student hoped can difference descrete and continuous random variables | Random Variables | a. Random Variables<br>b. Probability Distributions | 150 | [1], [2], and [3] |
| 4. | Student hoped able to use transform random variables | Univariate Transformation | Univariate Transformation | 150 | [1], [2], and [3] |
| 5. | Students could define moment generating function | Moment Generating Function | a. Expected Value<br>b. Moment Generating Function | 150 | [1] and [2] |

| | | | | | |
|---|---|---|---|---|---|
| 6. | Student could apply binomial and hipergeometric distributions | Binomial Distribution | a. Binomial Distribution<br>b. Hipergeometric Distribution | 150 | [1] and [2] |
| 7. | Students able to apply Poisson distribution | Poisson Distribution | a. Poisson Distribution<br>b. Uniform Distribution | 150 | [1] and [2] |
| 8. | Student expected could determine gamma distribution | Gamma Distibution | a. Gamma Distribution<br>b. Chi-square Distribution | 150 | [1], [2], and [3] |
| 9. | Student could use normal distribution | Normal Distribution | Normal Distribution Application | 150 | [1], [2], and [3] |
| 10. | Student can explain bivariate distribution | Bivariate Distribution | a. Bivariate Distribution<br>b. Independent Random Variables | 150 | [1], and [3] |
| 11. | Student expected could do bivariete transformation | Bivariate Transformation | a. Sampling Theory<br>b. Bivariate Transformation | 150 | [3] |
| 12. | Student could analyze t distribution structure | Distribution-t | a. Beta Distribution<br>b. t Distribution<br>c. F Distribution | 150 | [3] |
| 13. | Students able to use moment generating function | Moment Generating Function Technic | Moment Generating Function Technic | 150 | [1] and [3] |
| 14. | Student expected could know central limit theorem | Central Limit Theorem | a. Mean Distribution<br>b. S Distribution<br>c. Central Limit Theorem | 150 | [3] |
| 15. | The student could discus to solve arise problems | Discussion | Task Discussion and Problem Solving | 150 | Modul |

## REFERENCES:


1. Bain L.J., *Introduction to Probability and Mathematical Statistics*, Second Edition, Duxbury Press, Belmont California, 1991.
2. Casella and Berger, *Statistics Inference*, Brooks/Cole Publishing Company, California, 1990.
3. Hogg, R.V. and Craig, A.T., *Introduction to Mathematical Statistics*, Fifth Edition, Prentice-Hall, Inc., New Jersey, 1995.

# LEARNING PROGRAM UNIT

| | |
|---|---|
| **COURSE** | **: MATHEMATICAL STATISTICS I** |
| **COURSE CODE** | **: PAS 206** |
| **SCU** | **: 3** |
| **DURATION** | **: 3 x 50 minutes** |
| **MEETING** | **: 1** |

**A. Instructional Objectives**

1. **General:**

   After study this course, the students see learning contract which will be done and talked the material.

2. **Specific:**

   After follow this course, the students could know learning contract and able to see probability, and combinatorics.

**B. Subjects:**

- Learning Contract
- Introduction Probability
- Combinatorics

**C. Sub Subject:**

- Studying System
- Law of Probability
- Combinatorics Computation

**D. Teching-Learning Activities:**

| Activity Stage | Lecturer Activities | Student Activities | Learning Media |
|---|---|---|---|
| **Introduction** | 1. Give learning contract would be done<br>2. Explain material contains<br>3. Explain advantage to study probability and combinatorics | Seeing and writing | 1. OHP<br>2. Transparancy<br>3. White Board<br>4. Modul |
| **Presentation** | 4. Explain studying system and grading<br>5. Define probability<br>6. Explain combinatoric computation<br>7. Give examples topics, respectively<br>8. Ask to students about random variable as feed back | Watching and asking | 1. OHP<br>2. Transparancy<br>3. White Board<br>4. Modul |
| **Closing** | 9. Conclude all materials had been given in this meeting<br>10. Get general map about material to the next meeting<br>11. Get comment about good study | Seeing, writing and asking | White Board |

**E. Evaluation** : ---

**F. References** :


1. Bain L.J., *Introduction to Probability and Mathematical Statistics*, Second Edition, Duxbury Press, Belmont California, 1991.
2. Casella and Berger, *Statistics Inference*, Brooks/Cole Publishing Company, California, 1990.

## LEARNING PROGRAM UNIT

| | |
|---|---|
| **COURSE** | **: MATHEMATICAL STATISTICS I** |
| **COURSE CODE** | **: PAS 206** |
| **SCU** | **: 3** |
| **DURATION** | **: 9 x 50 minutes** |
| **MEETING** | **: 2, 3 and 4** |

### A. Instructional Objectives

1. **General:**

   After study this course, the students could explain meaning of conditional probability, random variable and it transformation.

2. **Specific:**

   After attend this meeting, the student could say independent events and Bayes theorem, and probability distribution.

### B. Subjects:

- Conditional Probability
- Random Variable
- Random Variable Transformation

### C. Sub Subjects:

- Definition of Conditional Probability
- Definition of Independent Event
- Bayes Theorem
- Definition of Random Variable
- Probaility Distributions
- Univariate Random Variable Transformation

**D. Teaching-Learning Activities:**

| Activity Stage | Lecturer Activities | Student Activities | Learning Media |
|---|---|---|---|
| **Introduction** | 1. Explain the material would be said<br>2. Recall the relation material ago<br>3. Give example conditional probability and it distribution in real life | Seeing and writing | 1. OHP<br>2. Transparancy<br>3. White Board<br>4. Modul |
| **Presentation** | 4. Explain conditional probability<br>5. Get independent events<br>6. Apply Bayes theorem<br>7. Explain probability distribution<br>8. Give examples the matter, respectively<br>9. Ask to student about random variables and their transformation as feed back | Watching and asking | 1. OHP<br>2. Transparancy<br>3. White Board<br>4. Modul |
| **Closing** | 10. Conclude all the matter which had been given<br>11. Give inform next material for tomorrow meeting | Concerning, writing and asking | White Board |

**E. Evaluation** : Give excercises and Task I for be done.

**F. References** :


1. Bain L.J., *Introduction to Probability and Mathematical Statistics*, Second Edition, Duxbury Press, Belmont California, 1991.
2. Casella and Berger, *Statistics Inference*, Brooks/Cole Publishing Company, California, 1990.
3. Hogg, R.V. and Craig, A.T., *Introduction to Mathematical Statistics*, Fifth Edition, Prentice-Hall, Inc., New Jersey, 1995.

# LEARNING PROGRAM UNIT

| | |
|---|---|
| **COURSE** | **: MATHEMATICAL STATISTICS I** |
| **COURSE CODE** | **: PAS 206** |
| **SCU** | **: 3** |
| **DURATION** | **: 9 x 50 minutes** |
| **MEETING** | **: 5, 6 and 7** |

**A. Tujuan Instruksional**

1. **Umum:**

   After finish this lecture, the students could know expected value, use binomial and Poisson distribution.

2. **Specific:**

   After follow this meeting, the students able to determine Jacobian transformation, observe moment generating function and apply uniform distribution as negative binomial distributions.

**B. Subjects:**

- Expected Value
- Moment Generating Function
- Binomial Distribution
- Poisson Distribution

**C. Sub Subjects:**

- Jacobian Transformation
- Conditional Expected Value
- Binomial and Hipergeometric Distributions
- Geometric and Poisson Distributions
- Uniform and Negative Binomial Distributions

**D. Teaching-Learning Activities:**

| Activity Stage | Lecturer Activities | Student Activities | Learning Media |
|---|---|---|---|
| **Intriduction** | 1. Remind matter by short with last metting<br>2. Explain the matter would be done<br>3. Get chance asking, if there is a matter problem | Seeing and writing | 1. OHP<br>2. Transparancy<br>3. White Board<br>4. Modul |
| **Presentation** | 4. Define expected value<br>5. Determine meaning of moment generating function<br>6. Count and use binomial and Poisson distributions<br>7. Give example of the subjects, respectively<br>8. Ask to students about the matter as feed back<br>9. Get problem solving for good absorbtion of the materials | Watching, asking and discussing | 1. OHP<br>2. Transparancy<br>3. White Board<br>4. Modul |
| **Closing** | 10. Conclude all of the materials had been given<br>11. Give critics and propose studying result<br>12. Give informations about midsemester exam | Watching, writing, and discussing | White Board |

**E. Evaluation** : Problem Solving and discussion.

**F. References** :


1. Bain L.J., *Introduction to Probability and Mathematical Statistics*, Second Edition, Duxbury Press, Belmont California, 1991.
2. Casella and Berger, *Statistics Inference*, Brooks/Cole Publishing Company, California, 1990.

# LEARNING PROGRAM UNIT

| | |
|---|---|
| **COURSE** | **: MATHEMATICAL STATISTICS I** |
| **COURSE CODE** | **: PAS 206** |
| **SCU** | **: 3** |
| **DURATION** | **: 12 x 50 minutes** |
| **MEETING** | **: 9, 10, 11 and 12** |

**A. Instructional Objectives**

1. **General:**

   After finish this course, the students could explain to order gamma with chi-square distributions, apply normal distribution, prove independent random variables, and do bivariate transformations.

2. **Specific:**

   After attend this meeting, the students are able to analyze gamma distribution, determine chi-square and normal properties, apply sampling theory, and use bivariate transformations.

**B. Subjects:**

- Gamma Distribution
- Normal Distribution
- Bivariate Distributions
- Sampling Theory

**C. Sub Subjects:**

- Chi-square Distribution
- Independent Random Variables
- Random Samples
- Application of Bivariate Transformations

**D. Teaching-Leaning Activities:**

| Activity Stage | Lecturer Activities | Student Activities | Learning Media |
|---|---|---|---|
| **Introduction** | 1. Short solve midsemester exam<br>2. Recall important matter on study ago<br>3. Explain the matter which will be discussion<br>4. Give ask time, if there is absorbing material problem | Watching and writing | 1. OHP<br>2. Transparancy<br>3. White Board<br>4. Modul |
| **Presentation** | 5. Describe gamma and chi-square distributions<br>6. Apply Norman distribution<br>7. Explain bivariate distribution<br>8. Describe mean independent random variables<br>9. Use bivariate transformations<br>10. Ask to students as feed back | Seeing, asking, and discussing | 1. OHP<br>2. Transparancy<br>3. White Board<br>4. Modul |
| **Closing** | 11. Conclude the matter had been given<br>12. Give motivations about good learning | Following, writing and discussing | White Board |

**E. Evaluation** : Problem Solving and Task II.

**F. References** :


1. Bain L.J., *Introduction to Probability and Mathematical Statistics*, Second Edition, Duxbury Press, Belmont California, 1991.
2. Casella and Berger, *Statistics Inference*, Brooks/Cole Publishing Company, California, 1990.
3. Hogg, R.V. and Craig, A.T., *Introduction to Mathematical Statistics*, Fifth Edition, Prentice-Hall, Inc., New Jersey, 1995.

# LEARNING PROGRAM UNIT

| | |
|---|---|
| **COURSE** | **: MATHEMATICAL STATISTICS I** |
| **COURSE CODE** | **: PAS 206** |
| **SCU** | **: 3** |
| **DURATION** | **: 12 x 50 minutes** |
| **MEETING** | **: 13, 14, 15 and 16** |

**A. Instructional Objectives**

1. **General:**

   After meeting this course, hoped students able to describe beta distribution, define t and F distribution, use moment generating function technic, and apply central limit theorem.

2. **Specific:**

   After finish this meeting, the students hoped can able to difference beta, t and F distributions, look for mean and S distributions, and use central limit theorem.

**B. Subjects:**

- Beta, t, and F Distributions
- Moment Generating Function Technic
- Central Limit Theorem

**C. Sub Subjects:**

- Properties of beta, t, and F Distributions
- Application of Moment Generating Functions
- Mean and S Distributions
- Application of Central Limit Theorem
- Problem Solving

**D. Teaching-Learning Activities:**

| Activity Stage | Lecturer Activities | Student Activities | Learning Media |
|---|---|---|---|
| **Introduction** | 1. Give chance to propose about the matter<br>2. Explain about that matter<br>3. Analyze student learning development | Watching and writing | 1. OHP<br>2. Transparancy<br>3. White Board<br>4. Modul |
| **Presentation** | 4. Say meaning about beta, t, and F distributions<br>5. Explain moment generating function method<br>6. Verify mean and S distribution<br>7. Apply central limit theorem<br>8. Discus given task<br>9. Discussion and problem solving<br>10. Get question to student as feed back | Seeing, asking and discussing | 1. OHP<br>2. Transparancy<br>3. White Board<br>4. Modul |
| **Closing** | 11. Conclude the given matter<br>12. Memotive students in order to good absorbing material<br>13. Give information about semester final exam | Seeing, writing, and discussion | White Board |

**E. Evaluation** : Discussion, Doing Task and Problem Solving.

**F. References** :


1. Bain L.J., *Introduction to Probability and Mathematical Statistics*, Second Edition, Duxbury Press, Belmont California, 1991.
2. Hogg, R.V. and Craig, A.T., *Introduction to Mathematical Statistics*, Fifth Edition, Prentice-Hall, Inc., New Jersey, 1995.