GBBP & SAP
SEMESTER V dan VI

KURIKULUM
JURUSAN TEKNIK MESIN
FAKULTAS TEKNIK – UNDIP
Tahun 2007

GARIS-GARIS BESAR PROGRAM PEMBELAJARAN

JUDUL MATA KULIAH : METODE NUMERIK
NOMOR KODE/SKS : TKM-314 / 3 SKS
DESKRIPSI SINGKAT : Mtakuliah ini dimaksudkan untuk memberi pemahaman kepada mahasiswa mengenai solusi praktis terhadap formulasi matematis yang diberikan. Merupakan matakuliah wajib yang disajikan pada semester V. Peserta telah mengambil matakuliah Aljabar Linier dan Matematika Teknik
TUJUAN INSTRUKSIONAL UMUM : - Memahami metoda-metoda numerik dasar yang telah dikembangkan saat ini
- Mampu memilih metoda numerik yang sesuai guna analisis masalah rekayasa yang dihadapi
- Mampu menyusun dan/atau mengaplikasikan progam komputasi metoda numerik sesuai dengan kebutuhan

No	TUJUAN INSTRUKSIONAL KHUSUS	POKOK BAHASAN	SUB POKOK BAHASAN	ESTIMASI WAKTU (MENIT)	METODE PEMBELAJARAN	KEMAMPUAN SOFT SKILL	SUMBER KEPUSTAKAAN
1	- Understand various analysis method in engineering field - Understand basic principle of numerical method	Introduction	- Numerical method definition - Solving method in engineering field - Basic consideration for choosing numerical method	100	- Presentation - Discussion - Self-supporting activity	- Ability for giving opinion - Ability for understanding others opinion - Ability for self-supporting activity	Pustaka 4
2	- Understand Types of error - Able to do error analysis	Approximation and Error	- Basic Principle of Numerical method - Type of error - Error analysis	150	- Presentation - Discussion - Self-supporting activity	- Ability for giving opinion - Ability for understanding others opinion - Ability for self-supporting activity	Pustaka 4
3	- Ability to solve roots equation problem using bracketing and open method - Able to do error analysis	Roots Equation	- Iteration method - Bisection method - Linear iteration method - Newton Rhapson method - Secant method - Polynomial roots	150	- Presentation - Discussion - Self-supporting activity	- Ability for giving opinion - Ability for understanding others opinion - Ability for self-supporting activity	Pustaka 1, 2 ,3, 4
4	- Ability to solve linear algebra equation	Linear algebra equation system	- Matrix definition - Gauss elimination method - Gauss-Seidell elimination method - Newton Rhapson method - Matrix decomposition (Doolittle and Cholesky method)	150	- Presentation - Discussion - Self-supporting activity	- Ability for giving opinion - Ability for understanding others opinion - Ability for self-supporting activity	Pustaka 1, 2 ,3, 4
5	- Ability to understand eigen value problem in engineering fiel - Able to determine eigen value and eigen vector using iteration method	Eigen value problem and Eigen vector	- The definition of eigen value and eigen vector - Problem solving of eigen value using iteration method	150	- Presentation - Discussion - Self-supporting activity	- Ability for giving opinion - Ability for understanding others opinion - Ability for self-supporting activity	Pustaka 3, 5

6	- Ability to understand lowest order method for curve approximation from given data - Able to determine the most suitable method for curves approximation from given data	Regresion analysis	- Lowest order method for linear curves - Unlinear curves linearity - Polynomial regresion	150	- Presentation - Discussion - Self-supporting activity	- Ability for giving opinion - Ability for understanding others opinion - Ability for self-supporting activity	Pustaka 1, 2 ,3, 4
7	- Ability to understand and to use interpolation method	Interpolation	- Linear interpolation - Square interpolation - Polynomial interpolation - Lagrange interpolation	150	- Presentation - Discussion - Self-supporting activity	- Ability for giving opinion - Ability for understanding others opinion - Ability for self-supporting activity	Pustaka 1, 2 ,3, 4
8	- Ability to understand and to use numerical integral method	Numerical integral	- Trapezium Rules - Simpson rules - Gauss kuadratur	150	- Presentation - Discussion - Self-supporting activity	- Ability for giving opinion - Ability for understanding others opinion - Ability for self-supporting activity	Pustaka 1, 2 ,3, 4
9	- Ability to understand and to use numerical differentiaton method	Numerical differential	- Forward difference formula - Backward difference formula - Center difference formula	150	- Presentation - Discussion - Self-supporting activity	- Ability for giving opinion - Ability for understanding others opinion - Ability for self-supporting activity	Pustaka 1, 3, 4
10	- Ability to find solution for common differential equation using numerical method	Common differential equation	- One step method - Heun method - Euler method - Runge-Kutta method - Predictor-Corrector method	150	- Presentation - Discussion - Self-supporting activity	- Ability for giving opinion - Ability for understanding others opinion - Ability for self-supporting activity	Pustaka 1, 2 ,3, 4
11	- Ability to find solution for partial differential equation using numerical method	Partial differential equation	- Parabolic equation solution - Implicit scheme - Explicit scheme - Crank-Nicholson Scheme - Ellipse solution equation - Hiperbolic olustion equation	150	- Presentation - Discussion - Self-supporting activity	- Ability for giving opinion - Ability for understanding others opinion - Ability for self-supporting activity	Pustaka 1, 2 ,3, 4
12	- Ability to compile numeric formulation for engineering problems also to compile computer program to find its solution	Project	Project procedure with various topic	-	- Self-supporting activity	- Ability for giving opinion - Ability for self-supporting activity	Berbagai sumber pustaka

Pustaka :

1. Haryanto, I, *Modul Kuliah Metoda Numerik*, Jurusan Teknik Mesin UNDIP, 2007
2. Chapra, Canale, *Numerical Methods For Engineers*, McGraw-Hill Book Co.

3. Kreyszig, *Advanced Eingineering Mathematic*, 9th ed. John Wiley & Sohns
4. Djojodihardjo, *Metode Numerik* , Gramedia, 2000
5. Epperson, *An Introduction to Numerical Methods and Analysis*, John Wiley & Sons, Inc

STANDARD COURSE OUTLINE

Subject : NUMERICAL METHOD
Subject Code : TKM 314
Subject Credit : 3
Class schedule : 1 x 100 minutes
Lecture : 1st

A. Course Objective
1. General Objective : - Understand the development of basic numerical method at the present time
- Able to choose the most suitable numerical method to analyze engineering problem
- Able to compile numerical method computer program
2. Specific Objective : - Understand various analysis method in engineering field
- Understand basic principle of numerical method

B. Desirable student competencies:
- Ability for giving opinion
- Ability for understanding others opinion
- Ability for self-supporting activity

C. Course Method:
- Presentation
- Discussion
- Self-supporting activity

D. Main course description:
Introduction

E. Sub Course description:
- Numerical method definition
- Solving method in engineering field
- Basic consideration for choosing numerical method

F. Course Activity:

No	PROGRESSION	TIME ESTIMATION	LECTURER ACTIVITY	STUDENT ACTIVITY	RESOURCES COMMONLY AVAILABLE
1	INTRODUCTION	20	Introduction to numerical method	Listening	LCD White board Computer
2	PRESENTATION	70	Detail explanation about: - Numerical method definition - Solving method in engineering field - Basic consideration for choosing numerical method	Paying attention Q & A	LCD White board Color marker
3	CLOSING	10	-Giving course conclusion - Feedback question	Q &A	LCD White board Color marker

G. Method of assessment
Self tasking problem

H. Text Book
Djojodihardjo, *Metode Numerik* , Gramedia, 2000

STANDARD COURSE OUTLINE

Subject : NUMERICAL METHOD
Subject Code : TKM 314
Subject Credit : 3
Class schedule : 1 x 150 minutes
Lecture : 2nd

A. Course Objective
1. General Objective : - Understand the development of basic numerical method at the present time
- Able to choose the most suitable numerical method to analyze engineering problem
- Able to compile numerical method computer program
2. Specific Objective : - Understand Types of error
- Able to do error analysis

B. Desirable student competencies:
- Ability for giving opinion
- Ability for understanding others opinion
- Ability for self-supporting activity

C. Course Method:
- Presentation
- Discussion
- Self-supporting activity

D. Main course description:
Approximation and Error

E. Sub Course description:
- Basic Principle of Numerical method
- Type of error
- Error analysis

F. Course Activity:

No	PROGRESSION	TIME ESTIMATION	LECTURER ACTIVITY	STUDENT ACTIVITY	RESOURCES COMMONLY AVAILABLE
1	INTRODUCTION	20	Introduction to Approximation and Error	Listening	LCD White board Computer
2	PRESENTATION	70	Detail explanation about: - Basic Principle of Numerical method - Type of error - Error analysis	Paying attention Q & A	LCD White board Color marker
3	CLOSING	10	-Giving course conclusion - Feedback question	Q &A	LCD White board Color marker

G. Method of assessment
Self tasking problem

H. Text Book
Djojodihardjo, *Metode Numerik* , Gramedia, 2000

STANDARD COURSE OUTLINE

Subject : NUMERICAL METHOD
Subject Code : TKM 314
Subject Credit : 3
Class schedule : 1 x 150 minutes
Lecture : 3rd

A. Course Objective
1. General Objective : - Understand the development of basic numerical method at the present time
- Able to choose the most suitable numerical method to analyze engineering problem
- Able to compile numerical method computer program
2. Specific Objective : - Ability to solve roots equation problem using bracketing and open method
- Able to do error analysis

B. Desirable student competencies:
- Ability for giving opinion
- Ability for understanding others opinion
- Ability for self-supporting activity

C. Course Method:
- Presentation
- Discussion
- Self-supporting activity

D. Main course description:
Roots Equation

E. Sub Course description:
- Iteration method
- Bisection method
- Linear iteration method
- Newton Rhapson method
- Secant method
- Polynomial roots

F. Course Activity:

No	PROGRESSION	TIME ESTIMATION	LECTURER ACTIVITY	STUDENT ACTIVITY	RESOURCES COMMONLY AVAILABLE
1	INTRODUCTION	20	Introduction to roots sequation and sudy cases in mechanical engineering	Listening	LCD White board Computer
2	PRESENTATION	70	Detail explanation about: - Iteration method - Bisection method - Linear iteration method - Newton Rhapson method - Secant method - Polynomial roots	Paying attention Q & A	LCD White board Color marker
3	CLOSING	10	-Giving course conclusion - Feedback question	Q &A	LCD White board Color marker

G. Method of assessment
Self tasking problem

H. Text Book

Haryanto, I, *Modul Kuliah Metoda Numerik*, Jurusan Teknik Mesin UNDIP, 2007

Chapra, Canale, *Numerical Methods For Engineers*, McGraw-Hill Book Co.

Kreyszig, *Advanced Eingineering Mathematic*, 9th ed. John Wiley & Sohns

Djojodihardjo, *Metode Numerik* , Gramedia, 2000

STANDARD COURSE OUTLINE

Subject : NUMERICAL METHOD
Subject Code : TKM 314
Subject Credit : 3
Class schedule : 1 x 150 minutes
Lecture : 4th

A. Course Objective
1. General Objective : - Understand the development of basic numerical method at the present time
- Able to choose the most suitable numerical method to analyze engineering problem
- Able to compile numerical method computer program
2. Specific Objective : - Ability to solve linear algebra equation

B. Desirable student competencies:
- Ability for giving opinion
- Ability for understanding others opinion
- Ability for self-supporting activity

C. Course Method:
- Presentation
- Discussion
- Self-supporting activity

D. Main course description:
Linear algebra equation system

E. Sub Course description:
- Matrix definition
- Gauss elimination method
- Gauss-Seidell elimination method
- Newton Rhapson method
- Matrix decomposition (Doolittle and Cholesky method)

F. Course Activity:

No	PROGRESSION	TIME ESTIMATION	LECTURER ACTIVITY	STUDENT ACTIVITY	RESOURCES COMMONLY AVAILABLE
1	INTRODUCTION	20	Introduction to Linear algebra equation system basic principle	Listening	LCD White board Computer
2	PRESENTATION	70	Detail explanation about: - Matrix definition - Gauss elimination method - Gauss-Seidell elimination method - Newton Rhapson method - Matrix decomposition (Doolittle and Cholesky method	Paying attention Q & A	LCD White board Color marker
3	CLOSING	10	-Giving course conclusion - Feedback question	Q &A	LCD White board Color marker

G. Method of assessment
Self tasking problem

H. Text Book

Haryanto, I, *Modul Kuliah Metoda Numerik*, Jurusan Teknik Mesin UNDIP, 2007

Chapra, Canale, *Numerical Methods For Engineers*, McGraw-Hill Book Co.

Kreyszig, *Advanced Eingineering Mathematic*, 9th ed. John Wiley & Sohns

Djojodihardjo, *Metode Numerik* , Gramedia, 2000

STANDARD COURSE OUTLINE

Subject : NUMERICAL METHOD
Subject Code : TKM 314
Subject Credit : 3
Class schedule : 1 x 150 minutes
Lecture : 5th

A. Course Objective
1. General Objective : - Understand the development of basic numerical method at the present time
- Able to choose the most suitable numerical method to analyze engineering problem
- Able to compile numerical method computer program
2. Specific Objective : - Ability to understand eigen value problem in engineering field
- Able to determine eigen value and eigen vector using iteration method

B. Desirable student competencies:
- Ability for giving opinion
- Ability for understanding others opinion
- Ability for self-supporting activity

C. Course Method:
- Presentation
- Discussion
- Self-supporting activity

D. Main course description:
Eigen value problem and Eigen vector

E. Sub Course description:
- The definition of eigen value and eigen vector
- Problem solving of eigen value using iteration method

F. Course Activity:

No	PROGRESSION	TIME ESTIMATION	LECTURER ACTIVITY	STUDENT ACTIVITY	RESOURCES COMMONLY AVAILABLE
1	INTRODUCTION	20	Eigen value problem basic principle	Listening	LCD White board Computer
2	PRESENTATION	70	Detail explanation about: - The definition of eigen value and eigen vector - Problem solving of eigen value using iteration method	Paying attention Q & A	LCD White board Color marker
3	CLOSING	10	-Giving course conclusion - Feedback question	Q &A	LCD White board Color marker

G. Method of assessment
Self tasking problem

H. Text Book

Haryanto, I, *Modul Kuliah Metoda Numerik*, Jurusan Teknik Mesin UNDIP, 2007

Chapra, Canale, *Numerical Methods For Engineers*, McGraw-Hill Book Co.

Kreyszig, *Advanced Eingineering Mathematic*, 9th ed. John Wiley & Sohns

Djojodihardjo, *Metode Numerik* , Gramedia, 2000

STANDARD COURSE OUTLINE

Subject : NUMERICAL METHOD
Subject Code : TKM 314
Subject Credit : 3
Class schedule : 1 x 150 minutes
Lecture : 6th

A. Course Objective
1. General Objective : - Understand the development of basic numerical method at the present time
- Able to choose the most suitable numerical method to analyze engineering problem
- Able to compile numerical method computer program
2. Specific Objective : - Ability to understand lowest order method for curve approximation from given data
- Able to determine the most suitable method for curves approximation from given data

B. Desirable student competencies:
- Ability for giving opinion
- Ability for understanding others opinion
- Ability for self-supporting activity

C. Course Method:
- Presentation
- Discussion
- Self-supporting activity

D. Main course description:
Regresion analysis

E. Sub Course description:
- Lowest order method for linear curves
- Unlinear curves linearity
- Polynomial regresion

F. Course Activity:

No	PROGRESSION	TIME ESTIMATION	LECTURER ACTIVITY	STUDENT ACTIVITY	RESOURCES COMMONLY AVAILABLE
1	INTRODUCTION	20	Explaining about regression analysis in mechanical engineering field	Listening	LCD White board Computer
2	PRESENTATION	70	Detail explanation about: - Lowest order method for linear curves - Unlinear curves linearity - Polynomial regresion	Paying attention Q & A	LCD White board Color marker
3	CLOSING	10	-Giving course conclusion - Feedback question	Q &A	LCD White board Color marker

G. Method of assessment
Self tasking problem

H. Text Book

Haryanto, I, *Modul Kuliah Metoda Numerik*, Jurusan Teknik Mesin UNDIP, 2007

Chapra, Canale, *Numerical Methods For Engineers*, McGraw-Hill Book Co.

Kreyszig, *Advanced Eingineering Mathematic*, 9th ed. John Wiley & Sohns

Djojodihardjo, *Metode Numerik* , Gramedia, 2000

STANDARD COURSE OUTLINE

Subject : NUMERICAL METHOD
Subject Code : TKM 314
Subject Credit : 3
Class schedule : 1 x 150 minutes
Lecture : 7th

A. Course Objective
1. General Objective : - Understand the development of basic numerical method at the present time
- Able to choose the most suitable numerical method to analyze engineering problem
- Able to compile numerical method computer program
2. Specific Objective : - Ability to understand and to use interpolation method

B. Desirable student competencies:
- Ability for giving opinion
- Ability for understanding others opinion
- Ability for self-supporting activity

C. Course Method:
- Presentation
- Discussion
- Self-supporting activity

D. Main course description:
Interpolation

E. Sub Course description:
- Linear interpolation
- Square interpolation
- Polynomial interpolation
- Lagrange interpolation

F. Course Activity:

No	PROGRESSION	TIME ESTIMATION	LECTURER ACTIVITY	STUDENT ACTIVITY	RESOURCES COMMONLY AVAILABLE
1	INTRODUCTION	20	Explaining about interpolation in mechanical engineering field	Listening	LCD White board Computer
2	PRESENTATION	70	Detail explanation about: - Linear interpolation - Square interpolation - Polynomial interpolation - Lagrange interpolation	Paying attention Q & A	LCD White board Color marker
3	CLOSING	10	-Giving course conclusion - Feedback question	Q &A	LCD White board Color marker

G. Method of assessment

Self tasking problem

H. Text Book

Haryanto, I, *Modul Kuliah Metoda Numerik*, Jurusan Teknik Mesin UNDIP, 2007

Chapra, Canale, *Numerical Methods For Engineers*, McGraw-Hill Book Co.

Kreyszig, *Advanced Eingineering Mathematic*, 9th ed. John Wiley & Sohns

Djojodihardjo, *Metode Numerik* , Gramedia, 2000

STANDARD COURSE OUTLINE

Subject : NUMERICAL METHOD
Subject Code : TKM 314
Subject Credit : 3
Class schedule : 1 x 150 minutes
Lecture : 8th

A. Course Objective
1. General Objective : - Understand the development of basic numerical method at the present time
- Able to choose the most suitable numerical method to analyze engineering problem
- Able to compile numerical method computer program
2. Specific Objective : - Ability to understand and to use numerical integral method

B. Desirable student competencies:
- Ability for giving opinion
- Ability for understanding others opinion
- Ability for self-supporting activity

C. Course Method:
- Presentation
- Discussion
- Self-supporting activity

D. Main course description:
Numerical integral

E. Sub Course description:
- Trapezium Rules
- Simpson rules
- Gauss kuadratur

F. Course Activity:

No	PROGRESSION	TIME ESTIMATION	LECTURER ACTIVITY	STUDENT ACTIVITY	RESOURCES COMMONLY AVAILABLE
1	INTRODUCTION	20	Explaining about numerical integral in mechanical engineering field	Listening	LCD White board Computer
2	PRESENTATION	70	Detail explanation about: - Trapezium Rules - Simpson rules - Gauss kuadratur	Paying attention Q & A	LCD White board Color marker
3	CLOSING	10	-Giving course conclusion - Feedback question	Q &A	LCD White board Color marker

G. Method of assessment
Self tasking problem

H. Text Book

Haryanto, I, *Modul Kuliah Metoda Numerik*, Jurusan Teknik Mesin UNDIP, 2007

Chapra, Canale, *Numerical Methods For Engineers*, McGraw-Hill Book Co.

Kreyszig, *Advanced Eingineering Mathematic*, 9th ed. John Wiley & Sohns

Djojodihardjo, *Metode Numerik* , Gramedia, 2000

STANDARD COURSE OUTLINE

Subject : NUMERICAL METHOD
Subject Code : TKM 314
Subject Credit : 3
Class schedule : 1 x 150 minutes
Lecture : 9th

A. Course Objective
1. General Objective : - Understand the development of basic numerical method at the present time
- Able to choose the most suitable numerical method to analyze engineering problem
- Able to compile numerical method computer program
2. Specific Objective : - Ability to understand and to use numerical differentiaton method

B. Desirable student competencies:
- Ability for giving opinion
- Ability for understanding others opinion
- Ability for self-supporting activity

C. Course Method:
- Presentation
- Discussion
- Self-supporting activity

D. Main course description:
Numerical differential

E. Sub Course description:
- Forward difference formula
- Backward difference formula
- Center difference formula

F. Course Activity:

No	PROGRESSION	TIME ESTIMATION	LECTURER ACTIVITY	STUDENT ACTIVITY	RESOURCES COMMONLY AVAILABLE
1	INTRODUCTION	20	Explaining about numerical differential in mechanical engineering field	Listening	LCD White board Computer
2	PRESENTATION	70	Detail explanation about: - Forward difference formula - Backward difference formula - Center difference formula	Paying attention Q & A	LCD White board Color marker
3	CLOSING	10	-Giving course conclusion - Feedback question	Q &A	LCD White board Color marker

G. Method of assessment

Self tasking problem

H. Text Book

Haryanto, I, *Modul Kuliah Metoda Numerik*, Jurusan Teknik Mesin UNDIP, 2007

Chapra, Canale, *Numerical Methods For Engineers*, McGraw-Hill Book Co.

Kreyszig, *Advanced Eingineering Mathematic*, 9th ed. John Wiley & Sohns

Djojodihardjo, *Metode Numerik* , Gramedia, 2000

STANDARD COURSE OUTLINE

Subject : NUMERICAL METHOD
Subject Code : TKM 314
Subject Credit : 3
Class schedule : 1 x 150 minutes
Lecture : 10^{th}

A. Course Objective
1. General Objective : - Understand the development of basic numerical method at the present time
- Able to choose the most suitable numerical method to analyze engineering problem
- Able to compile numerical method computer program
2. Specific Objective : - Ability to find solution for common differential equation using numerical method

B. Desirable student competencies:
- Ability for giving opinion
- Ability for understanding others opinion
- Ability for self-supporting activity

C. Course Method:
- Presentation
- Discussion
- Self-supporting activity

D. Main course description:
Common differential equation

E. Sub Course description:
- one step method
- Heun method
- Euler method
- Runge-Kutta method
- Predictor-Corrector method

F. Course Activity:

No	PROGRESSION	TIME ESTIMATION	LECTURER ACTIVITY	STUDENT ACTIVITY	RESOURCES COMMONLY AVAILABLE
1	INTRODUCTION	20	Explaining about Common differential equation solution in mechanical engineering field	Listening	LCD White board Computer
2	PRESENTATION	70	Detail explanation about: - one step method - Heun method - Euler method - Runge-Kutta method - Predictor-Corrector method	Paying attention Q & A	LCD White board Color marker
3	CLOSING	10	-Giving course conclusion - Feedback question	Q &A	LCD White board Color marker

G. Method of assessment
Self tasking problem

H. Text Book

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Chapra, Canale, *Numerical Methods For Engineers*, McGraw-Hill Book Co.

Kreyszig, *Advanced Eingineering Mathematic,* 9th ed. John Wiley & Sohns

Djojodihardjo, *Metode Numerik* , Gramedia, 2000

STANDARD COURSE OUTLINE

Subject : NUMERICAL METHOD
Subject Code : TKM 314
Subject Credit : 3
Class schedule : 1 x 150 minutes
Lecture : 11th

A. Course Objective
1. General Objective : - Understand the development of basic numerical method at the present time
- Able to choose the most suitable numerical method to analyze engineering problem
- Able to compile numerical method computer program
2. Specific Objective : - Ability to find solution for partial differential equation using numerical method

B. Desirable student competencies:
- Ability for giving opinion
- Ability for understanding others opinion
- Ability for self-supporting activity

C. Course Method:
- Presentation
- Discussion
- Self-supporting activity

D. Main course description:
Partial differential equation

E. Sub Course description:
- Parabolic equation solution
- Implicit scheme
- Explicit scheme
- Crank-Nicholson Scheme
- Ellipse solution equation
- Hiperbolic olustion equation

F. Course Activity:

No	PROGRESSION	TIME ESTIMATION	LECTURER ACTIVITY	STUDENT ACTIVITY	RESOURCES COMMONLY AVAILABLE
1	INTRODUCTION	20	Explaining about Partial differential equation solution in mechanical engineering field	Listening	LCD White board Computer
2	PRESENTATION	70	Detail explanation about: - Parabolic equation solution - Implicit scheme - Explicit scheme - Crank-Nicholson Scheme - Ellipse solution equation - Hiperbolic olustion equation	Paying attention Q & A	LCD White board Color marker
3	CLOSING	10	-Giving course conclusion - Feedback question	Q &A	LCD White board Color marker

G. Method of assessment
Self tasking problem

H. Text Book

Haryanto, I, *Modul Kuliah Metoda Numerik*, Jurusan Teknik Mesin UNDIP, 2007

Chapra, Canale, *Numerical Methods For Engineers*, McGraw-Hill Book Co.

Kreyszig, *Advanced Eingineering Mathematic*, 9th ed. John Wiley & Sohns

Djojodihardjo, *Metode Numerik* , Gramedia, 2000

STANDARD COURSE OUTLINE

Subject : NUMERICAL METHOD
Subject Code : TKM 314
Subject Credit : 3
Class schedule : 1 x 150 minutes
Lecture : 12th

A. Course Objective

1. General Objective : - Understand the development of basic numerical method at the present time
   - Able to choose the most suitable numerical method to analyze engineering problem
   - Able to compile numerical method computer program
2. Specific Objective : - Ability to compile numeric formulation for engineering problems also to compile computer program to find its solution

B. Desirable student competencies:
- Ability for giving opinion
- Ability for understanding others opinion
- Ability for self-supporting activity

C. Course Method:
- Presentation
- Discussion
- Self-supporting activity

D. Main course description:
Project

E. Sub Course description:
Project procedure

F. Course Activity:

No	PROGRESSION	TIME ESTIMATION	LECTURER ACTIVITY	STUDENT ACTIVITY	RESOURCES COMMONLY AVAILABLE
1	INTRODUCTION	20	Explaining about Porject background	Listening	LCD White board Computer
2	PRESENTATION	70	Detail explanation about: Project procedure	Paying attention Q & A	LCD White board Color marker
3	CLOSING	10	-Giving course conclusion - Feedback question	Q &A	LCD White board Color marker

G. Method of assessment
Self tasking problem

H. Text Book

Haryanto, I, *Modul Kuliah Metoda Numerik*, Jurusan Teknik Mesin UNDIP, 2007

Chapra, Canale, *Numerical Methods For Engineers*, McGraw-Hill Book Co.

Kreyszig, *Advanced Eingineering Mathematic,* 9th ed. John Wiley & Sohns

Djojodihardjo, *Metode Numerik* , Gramedia, 2000

SATUAN ACARA PEMBELAJARAN (SAP)

SUBJECTS TITLE	:	Heat Transfer II
SUBJECTS CODE	:	TKM 2 315
SEMESTER CREDIT UNITS	:	2 SCU
CLASS/LABORATORY SCHEDULE	:	90 minute, 1 time a week
LECTURE	:	1

A. COURSE OBJECTIVES
1. GENERAL OBJECTIVES : Students able to understand convection heat transfer concept

2 SPECIFIC OBJECTIVE : Students able to analyze convection heat transfer types

B. KEMAMPUAN SOFT SKILL : Build up interest to material course
C. COURSE METHOD : Lecture, question-answer

D. MAIN COURSE DESCRIPTION : Introduction on convection heat transfer
E. SUB COURSE DESCRIPTION : Convection heat transfer mechanism, force and natural convection
F. COURSE ACTIVITY

NO	STAGES	TIME ESTI MATE	LECTURER	STUDENT ACTIVITY	RESOURCES COMMONLY AVAILABLE
1	INTRODUCTION	10	General explanation	Following lecture	LCD-PowerPoint
2	PRESENTATIO N	70	Explain mechanism and convection heat transfer type	Following lecture	LCD-PowerPoint
3	CLOSING	10	Question-answer, conclusion etc.	Question-answer	Whiteboard

G. METHODS OF ASSESSMENT : Evaluation from question answer conclusion and assignment
H. TEXTBOOK :

Textbook:

1. F.P. Incropera & David P. Dewit : Fundamentals of Heat & Mass Transfer
2. JP. Holman : The Fundamental of Heat Transfer
3. F. KreithTheFundamental&HeatTransfer

SATUAN ACARA PEMBELAJARAN (SAP)

SUBJECTS TITLE	:	Heat Transfer II
SUBJECTS CODE	:	TKM 2
SEMESTER CREDIT UNITS	:	2 SCU
CLASS/LABORATORY SCHEDULE	:	90 minute, 1 time a week
LECTURE	:	2

A. COURSE OBJECTIVES

1. GENERAL OBJECTIVES : Students able to understand boundary layer concept on force convection

2 SPECIFIC OBJECTIVE : Students able to analyze bondary layer relation and convection heat transfer

B. KEMAMPUAN SOFT SKILL : Discipline, Systematic Thinking

C. COURSE METHOD : Lecture, question-answer

D. MAIN COURSE DESCRIPTION : Boundary layer

E. SUB COURSE DESCRIPTION : Boundary layer on plate surface

F. COURSE ACTIVITY

NO	STAGES	TIME ESTIMATE	LECTURER	STUDENT ACTIVITY	RESOURCES COMMONLY AVAILABLE
1	INTRODUCTION	10	General explanation	Following lecture	LCD-PowerPoint
2	PRESENTATION	70	Explain boundary layer and relation between	Following lecture	LCD-PowerPoint
3	CLOSING	10	Question-answer, conclusion etc.	Question-answer	Whiteboard

G. METHODS OF ASSESSMENT : Evaluation from question answer conclusion and assignment

H. TEXTBOOK :

Textbook:

1. F.P. Incropera & David P. Dewit : Fundamentals of Heat & Mass Transfer
2. JP. Holman : The Fundamental of Heat Transfer
3. F. KreithTheFundamental&HeatTransfer

SATUAN ACARA PEMBELAJARAN (SAP)

SUBJECTS TITLE	:	Heat Transfer II
SUBJECTS CODE	:	TKM 2
SEMESTER CREDIT UNITS	:	2 SCU
CLASS/LABORATORY SCHEDULE	:	90 minute, 1 time a week
LECTURE	:	3

A. COURSE OBJECTIVES

1. GENERAL OBJECTIVES : Students able to understand boundary layer concept and similarity

2 SPECIFIC OBJECTIVE : Students able to analyze boundary layer and convection heat transfer parameter

B. KEMAMPUAN SOFT SKILL : Discipline, Systematic Thinking

C. COURSE METHOD : Lecture, question-answer

D. MAIN COURSE DESCRIPTION : Boundary layer similarity

E. SUB COURSE DESCRIPTION : Force convection parameters

F. COURSE ACTIVITY

NO	STAGES	TIME ESTI MATE	LECTURER	STUDENT ACTIVITY	RESOURCES COMMONLY AVAILABLE
1	INTRODUCTION	10	General explanation	Following lecture	LCD-PowerPoint
2	PRESENTATIO N	70	Explain boundary layer and convection parameter	Following lecture	LCD-PowerPoint
3	CLOSING	10	Question-answer, conclusion etc.	Question-answer	Whiteboard

G. METHODS OF ASSESSMENT : Evaluation from question answer conclusion and assignment

H. TEXTBOOK :

Textbook:

1. F.P. Incropera & David P. Dewit : Fundamentals of Heat & Mass Transfer
2. JP. Holman : The Fundamental of Heat Transfer
3. F. KreithTheFundamental&HeatTransfer

SATUAN ACARA PEMBELAJARAN (SAP)

SUBJECTS TITLE	:	Heat Transfer II
SUBJECTS CODE	:	TKM 2
SEMESTER CREDIT UNITS	:	2 SCU
CLASS/LABORATORY SCHEDULE	:	90 minute, 1 time a week
LECTURE	:	4

A. COURSE OBJECTIVES

1. GENERAL OBJECTIVES : Students able to understand heat transfer force convection empirical equation derivation

2 SPECIFIC OBJECTIVE : Students able to use empirical equation on heat transfer force convection

B. KEMAMPUAN SOFT SKILL : Discipline, Systematic Thinking

C. COURSE METHOD : Lecture, question-answer

D. MAIN COURSE DESCRIPTION : Empirical equation on outer surface

E. SUB COURSE DESCRIPTION : Empirical equation uses to calculate heat transfer force convection

F. COURSE ACTIVITY

NO	STAGES	TIME ESTIMATE	LECTURER	STUDENT ACTIVITY	RESOURCES COMMONLY AVAILABLE
1	INTRODUCTION	10	General explanation	Following lecture	LCD-PowerPoint
2	PRESENTATION	70	Explain empirical equation use in force convection calculation	Following lecture	LCD-PowerPoint
3	CLOSING	10	Question-answer, conclusion etc.	Question-answer	Whiteboard

G. METHODS OF ASSESSMENT : Evaluation from question answer conclusion and assignment

H. TEXTBOOK :

Textbook:

1. F.P. Incropera & David P. Dewit : Fundamentals of Heat & Mass Transfer
2. JP. Holman : The Fundamental of Heat Transfer
3. F. KreithTheFundamental&HeatTransfer

SATUAN ACARA PEMBELAJARAN (SAP)

SUBJECTS TITLE	:	Heat Transfer II
SUBJECTS CODE	:	TKM 2
SEMESTER CREDIT UNITS	:	2 SCU
CLASS/LABORATORY SCHEDULE	:	90 minute, 1 time a week
LECTURE	:	5

A. COURSE OBJECTIVES

1. GENERAL OBJECTIVES : Students able to understand empirical equation derivation heat transfer force convection

2 SPECIFIC OBJECTIVE : Students able to use empirical equation on heat transfer case

B. KEMAMPUAN SOFT SKILL : Discipline, Systematic Thinking

C. COURSE METHOD : Lecture, question-answer

D. MAIN COURSE DESCRIPTION : Empirical equation on outer surface (advanced)

E. SUB COURSE DESCRIPTION : Empirical equation uses to calculate heat transfer force convection (advanced)

F. COURSE ACTIVITY

NO	STAGES	TIME ESTIMATE	LECTURER	STUDENT ACTIVITY	RESOURCES COMMONLY AVAILABLE
1	INTRODUCTION	10	General explanation (Advanced)	Following lecture	LCD-PowerPoint
2	PRESENTATION	70	Explain empirical equation in foce convection calculation	Following lecture	LCD-PowerPoint
3	CLOSING	10	Question-answer, conclusion etc.	Question-answer	Whiteboard

G. METHODS OF ASSESSMENT : Evaluation from question answer conclusion and assignment

H. TEXTBOOK :

Textbook:

1. F.P. Incropera & David P. Dewit : Fundamentals of Heat & Mass Transfer
2. JP. Holman : The Fundamental of Heat Transfer
3. F. KreithTheFundamental&HeatTransfer

SATUAN ACARA PEMBELAJARAN (SAP)

SUBJECTS TITLE	:	Heat Transfer II
SUBJECTS CODE	:	TKM 2
SEMESTER CREDIT UNITS	:	2 SCU
CLASS/LABORATORY SCHEDULE	:	90 minute, 1 time a week
LECTURE	:	6

A. COURSE OBJECTIVES

1. GENERAL OBJECTIVES : Students able to influence flow on a tube toward heat transfer force convection

2 SPECIFIC OBJECTIVE : Students able to use empirical equation on a tube heat transfer case force convection

B. KEMAMPUAN SOFT SKILL : Discipline, Systematic Thinking

C. COURSE METHOD : Lecture, question-answer

D. MAIN COURSE DESCRIPTION : Empirical equation on a tube

E. SUB COURSE DESCRIPTION : Empirical equation heat transfer force convection uses on atube

F. COURSE ACTIVITY

NO	STAGES	TIME ESTI MATE	LECTURER	STUDENT ACTIVITY	RESOURCES COMMONLY AVAILABLE
1	INTRODUCTION	10	General explanation (Advanced)	Following lecture	LCD-PowerPoint
2	PRESENTATIO N	70	Explain heat transfer calculation on a tube	Following lecture	LCD-PowerPoint
3	CLOSING	10	Question-answer, conclusion etc.	Question-answer	Whiteboard

G. METHODS OF ASSESSMENT : Evaluation from question answer conclusion and assignment

H. TEXTBOOK :

Textbook:

1. F.P. Incropera & David P. Dewit : Fundamentals of Heat & Mass Transfer
2. JP. Holman : The Fundamental of Heat Transfer
3. F. KreithTheFundamental&HeatTransfer

SATUAN ACARA PEMBELAJARAN (SAP)

SUBJECTS TITLE	:	Heat Transfer II
SUBJECTS CODE	:	TKM 2
SEMESTER CREDIT UNITS	:	2 SCU
CLASS/LABORATORY SCHEDULE	:	90 minute, 1 time a week
LECTURE	:	7

A. COURSE OBJECTIVES

1. GENERAL OBJECTIVES : Students able to understand flow in pipe influence toward heat transfer force convection

2 SPECIFIC OBJECTIVE : Students able to analyze velocity profile take place and fully developed region

B. KEMAMPUAN SOFT SKILL : Discipline, Systematic Thinking

C. COURSE METHOD : Lecture, question-answer

D. MAIN COURSE DESCRIPTION : Velocity profle inside pipe

E. SUB COURSE DESCRIPTION : Velocity profile, boundary layer thickness and fulliy developed flow

F. COURSE ACTIVITY

NO	STAGES	TIME ESTI MATE	LECTURER	STUDENT ACTIVITY	RESOURCES COMMONLY AVAILABLE
1	INTRODUCTION	10	General explanation	Following lecture	LCD-PowerPoint
2	PRESENTATIO N	70	Explain velocity profile occur and fully develop flow	Following lecture	LCD-PowerPoint
3	CLOSING	10	Question-answer, conclusion etc.	Question-answer	Whiteboard

G. METHODS OF ASSESSMENT : Evaluation from question answer conclusion and assignment

H. TEXTBOOK :

Textbook:

1. F.P. Incropera & David P. Dewit : Fundamentals of Heat & Mass Transfer
2. JP. Holman : The Fundamental of Heat Transfer
3. F. KreithTheFundamental&HeatTransfer

SATUAN ACARA PEMBELAJARAN (SAP)

SUBJECTS TITLE	:	Heat Transfer II
SUBJECTS CODE	:	TKM 2
SEMESTER CREDIT UNITS	:	2 SCU
CLASS/LABORATORY SCHEDULE	:	90 minute, 1 time a week
LECTURE	:	8

A. COURSE OBJECTIVES

1. GENERAL OBJECTIVES : Students able to understand heat transfer force convection calculation method inside pipe

2 SPECIFIC OBJECTIVE : Students able to analyze different convection calculation method inside pipe

B. KEMAMPUAN SOFT SKILL : Discipline, Systematic Thinking

C. COURSE METHOD : Lecture, question-answer

D. MAIN COURSE DESCRIPTION : Heat transfer convection calculation method inside pipe

E. SUB COURSE DESCRIPTION : Constant temperature method and constant heat flux

F. COURSE ACTIVITY

NO	STAGES	TIME ESTI MATE	LECTURER	STUDENT ACTIVITY	RESOURCES COMMONLY AVAILABLE
1	INTRODUCTION	10	General explanation	Following lecture	LCD-PowerPoint
2	PRESENTATIO N	70	Explain temperature method and constant heat flux	Following lecture	LCD-PowerPoint
3	CLOSING	10	Question-answer, conclusion etc.	Question-answer	Whiteboard

G. METHODS OF ASSESSMENT : Evaluation from question answer conclusion and assignment

H. TEXTBOOK :

Textbook:

1. F.P. Incropera & David P. Dewit : Fundamentals of Heat & Mass Transfer
2. JP. Holman : The Fundamental of Heat Transfer
3. F. KreithTheFundamental&HeatTransfer

SATUAN ACARA PEMBELAJARAN (SAP)

SUBJECTS TITLE	:	Heat Transfer II
SUBJECTS CODE	:	TKM 2
SEMESTER CREDIT UNITS	:	2 SCU
CLASS/LABORATORY SCHEDULE	:	90 minute, 1 time a week
LECTURE	:	9

A. COURSE OBJECTIVES

1. GENERAL OBJECTIVES : Students able to understand empirical equation application inside pipe

2 SPECIFIC OBJECTIVE : Students able to calculate heat transfer convection inside pipe

B. KEMAMPUAN SOFT SKILL : Discipline, Systematic Thinking

C. COURSE METHOD : Lecture, question-answer

D. MAIN COURSE DESCRIPTION : Empirical equation heat transfer convection inside pipe

E. SUB COURSE DESCRIPTION : Heat transfer force convection solution inside pipe

F. COURSE ACTIVITY

NO	STAGES	TIME ESTIMATE	LECTURER	STUDENT ACTIVITY	RESOURCES COMMONLY AVAILABLE
1	INTRODUCTION	10	General explanation	Following lecture	LCD-PowerPoint
2	PRESENTATION	70	Explain heat transfer solution inside pipe	Following lecture	LCD-PowerPoint
3	CLOSING	10	Question-answer, conclusion etc.	Question-answer	Whiteboard

G. METHODS OF ASSESSMENT : Evaluation from question answer conclusion and assignment

H. TEXTBOOK :

Textbook:

1. F.P. Incropera & David P. Dewit : Fundamentals of Heat & Mass Transfer
2. JP. Holman : The Fundamental of Heat Transfer
3. F. KreithTheFundamental&HeatTransfer

SATUAN ACARA PEMBELAJARAN (SAP)

SUBJECTS TITLE	:	Heat Transfer II
SUBJECTS CODE	:	TKM 2
SEMESTER CREDIT UNITS	:	2 SCU
CLASS/LABORATORY SCHEDULE	:	90 minute, 1 time a week
LECTURE	:	10

A. COURSE OBJECTIVES

1. GENERAL OBJECTIVES : Students able to understand natural convection take place

2 SPECIFIC OBJECTIVE : Students able to analyze mathematical natural convection laminar flow

B. KEMAMPUAN SOFT SKILL : Discipline, Systematic Thinking

C. COURSE METHOD : Lecture, question-answer

D. MAIN COURSE DESCRIPTION : Heat transfer natural convection

E. SUB COURSE DESCRIPTION : Physical observation, laminar flow and turbulence influence in natural convection

F. COURSE ACTIVITY

NO	STAGES	TIME ESTI MATE	LECTURER	STUDENT ACTIVITY	RESOURCES COMMONLY AVAILABLE
1	INTRODUCTION	10	General explanation	Following lecture	LCD-PowerPoint
2	PRESENTATIO N	70	Explain flow occur on natural convection	Following lecture	LCD-PowerPoint
3	CLOSING	10	Question-answer, conclusion etc.	Question-answer	Whiteboard

G. METHODS OF ASSESSMENT : Evaluation from question answer conclusion and assignment

H. TEXTBOOK :

Textbook:

1. F.P. Incropera & David P. Dewit : Fundamentals of Heat & Mass Transfer
2. JP. Holman : The Fundamental of Heat Transfer
3. F. KreithTheFundamental&HeatTransfer

SATUAN ACARA PEMBELAJARAN (SAP)

SUBJECTS TITLE	:	Heat Transfer II
SUBJECTS CODE	:	TKM 2
SEMESTER CREDIT UNITS	:	2 SCU
CLASS/LABORATORY SCHEDULE	:	90 minute, 1 time a week
LECTURE	:	11

A. COURSE OBJECTIVES

1. GENERAL OBJECTIVES : Students able to understand empirical equation application on natural convection case

2 SPECIFIC OBJECTIVE : Students able to calculate heat transfer natural convection in different field

B. KEMAMPUAN SOFT SKILL : Discipline, Systematic Thinking

C. COURSE METHOD : Lecture, question-answer

D. MAIN COURSE DESCRIPTION : Empirical equation heat transfer natural equation

E. SUB COURSE DESCRIPTION : Natural convection solution using empirical equation

F. COURSE ACTIVITY

NO	STAGES	TIME ESTIMATE	LECTURER	STUDENT ACTIVITY	RESOURCES COMMONLY AVAILABLE
1	INTRODUCTION	10	General explanation	Following lecture	LCD-PowerPoint
2	PRESENTATION	70	Explain empirical equation natural convection heat transfer	Following lecture	LCD-PowerPoint
3	CLOSING	10	Question-answer, conclusion etc.	Question-answer	Whiteboard

G. METHODS OF ASSESSMENT : Evaluation from question answer conclusion and assignment

H. TEXTBOOK :

Textbook:

1. F.P. Incropera & David P. Dewit : Fundamentals of Heat & Mass Transfer
2. JP. Holman : The Fundamental of Heat Transfer
3. F. KreithTheFundamental&HeatTransfer

SATUAN ACARA PEMBELAJARAN (SAP)

SUBJECTS TITLE	:	Heat Transfer II
SUBJECTS CODE	:	TKM 2
SEMESTER CREDIT UNITS	:	2 SCU
CLASS/LABORATORY SCHEDULE	:	90 minute, 1 time a week
LECTURE	:	12

A. COURSE OBJECTIVES

1. GENERAL OBJECTIVES : Students able to understand working principle and types heat exchanger

2 SPECIFIC OBJECTIVE : Students able to determine the right heat exchanger type in thermal unit design

B. KEMAMPUAN SOFT SKILL : Discipline, Systematic Thinking

C. COURSE METHOD : Lecture, question-answer

D. MAIN COURSE DESCRIPTION : Heat exchanger

E. SUB COURSE DESCRIPTION : Working principle and type heat exchanger

F. COURSE ACTIVITY

NO	STAGES	TIME ESTIMATE	LECTURER	STUDENT ACTIVITY	RESOURCES COMMONLY AVAILABLE
1	INTRODUCTION	10	General explanation	Following lecture	LCD-PowerPoint
2	PRESENTATION	70	Explain working principle and heat exchanger	Following lecture	LCD-PowerPoint
3	CLOSING	10	Question-answer, conclusion etc.	Question-answer	Whiteboard

G. METHODS OF ASSESSMENT : Evaluation from question answer conclusion and assignment

H. TEXTBOOK :

Textbook:

1. F.P. Incropera & David P. Dewit : Fundamentals of Heat & Mass Transfer
2. JP. Holman : The Fundamental of Heat Transfer
3. F. KreithTheFundamental&HeatTransfer

SATUAN ACARA PEMBELAJARAN (SAP)

SUBJECTS TITLE	:	Heat Transfer II
SUBJECTS CODE	:	TKM 2
SEMESTER CREDIT UNITS	:	2 SCU
CLASS/LABORATORY SCHEDULE	:	90 minute, 1 time a week
LECTURE	:	13

A. COURSE OBJECTIVES

1. GENERAL OBJECTIVES : Students able to understand thermal analysis steps on heat exchanger

2 SPECIFIC OBJECTIVE : Students able to calculate heat exchanger effectivity using different method

B. KEMAMPUAN SOFT SKILL : Discipline, Systematic Thinking

C. COURSE METHOD : Lecture, question-answer

D. MAIN COURSE DESCRIPTION : Heat exchanger thermal analysis

E. SUB COURSE DESCRIPTION : LMTD and NTU method

F. COURSE ACTIVITY

NO	STAGES	TIME ESTI MATE	LECTURER	STUDENT ACTIVITY	RESOURCES COMMONLY AVAILABLE
1	INTRODUCTION	10	General explanation	Following lecture	LCD-PowerPoint
2	PRESENTATIO N	70	Explain LMTD and NTU method	Following lecture	LCD-PowerPoint
3	CLOSING	10	Question-answer, conclusion etc.	Question-answer	Whiteboard

G. METHODS OF ASSESSMENT : Evaluation from question answer conclusion and assignment

H. TEXTBOOK :

Textbook:

1. F.P. Incropera & David P. Dewit : Fundamentals of Heat & Mass Transfer
2. JP. Holman : The Fundamental of Heat Transfer
3. F. KreithTheFundamental&HeatTransfer

SATUAN ACARA PEMBELAJARAN (SAP)

SUBJECTS TITLE	:	Heat Transfer II
SUBJECTS CODE	:	TKM 2
SEMESTER CREDIT UNITS	:	2 SCU
CLASS/LABORATORY SCHEDULE	:	90 minute, 1 time a week
LECTURE	:	14

A. COURSE OBJECTIVES

1. GENERAL OBJECTIVES : Students able to understand compact heat exchanger advantage and disadvantage

2 SPECIFIC OBJECTIVE : Students able to choose compact heat exchanger that fits with necessity

B. KEMAMPUAN SOFT SKILL : Discipline, Systematic Thinking

C. COURSE METHOD : Lecture, question-answer

D. MAIN COURSE DESCRIPTION : Compact heat exchanger

E. SUB COURSE DESCRIPTION : Compact heat exchanger types and properties

F. COURSE ACTIVITY

NO	STAGES	TIME ESTIMATE	LECTURER	STUDENT ACTIVITY	RESOURCES COMMONLY AVAILABLE
1	INTRODUCTION	10	General explanation	Following lecture	LCD-PowerPoint
2	PRESENTATION	70	Explain compact heat exchanger type and properties	Following lecture	LCD-PowerPoint
3	CLOSING	10	Question-answer, conclusion etc.	Question-answer	Whiteboard

G. METHODS OF ASSESSMENT : Evaluation from question answer conclusion and assignment

H. TEXTBOOK :

Textbook:

1. F.P. Incropera & David P. Dewit : Fundamentals of Heat & Mass Transfer
2. JP. Holman : The Fundamental of Heat Transfer
3. F. KreithTheFundamental&HeatTransfer

Subject : **CAD/CAM**
Subject Code : TKM 3 2 3
Short description : This course give general overview abut CAD/CAM technology to student. This course consist of CAD/CAM sytem, Geometric modelling, computer graphics, product design and development
General Objective : Understand basic concept on CAD/CAM technology. To Introduced and student Trained to use CAD/CAM software. Student introduction to real cases in industrial field concerning CAD/CAM. Introducing several tools on CAD/CAM

No	SPESIFIC OBJECTIVE	MAIN COURSE DESCRIPTION	SUB COURSE DESCRIPTION	TIME ESTIMATION (MENIT)	LEARNING METHOD	DESIRABLE STUDENT COMPETENCIES	TEXT BOOK SOURCE
1	Recognize Life cycle product concept, CAD/Cam application, 3D modeling theory, geometry model type, modeling tools	CAD/CAM system	General introduction, material behavior, alloy, steel, nonferro metal and its alloy, polymer and ceramics	150	Presentation, Question and Answer, Discussion., Task.	Internet literature and English language	Ref. 1
2	Drawing structure, projection method, View, dimension, and tolerance review on engineering drawing. Introduction to RDBMS and Object Oriented Programming	CAD/CAM programming and engineering drawing	Engineering drawing review and its attribute. Introduction to program and its application on CAD/CAM	150	Presentation, Question and Answer, Discussion., Task	Internet literature and English language	Ref. 1
3	Introduction to simple curve and mathematic model Introduction to synthetic curve and mathematic model Introduction to Hermita curve, Bezier and B-spline	Curves	Curves Geometric model and its definitions	150	Presentation, Question and Answer, Discussion., Task	Internet literature and English language	Ref. 1
4	Introduction to simple curve and mathematic model	Surfaces	Surface Geometric model and its definitions	150	Presentation, Question and Answer, Discussion., Task	Internet literature and English language	Ref. 1

	Introduction to synthetic curve and mathematic model						
5	Introduction to Curve and synthetic NURBS surface definition, Introduction to non-uniform rational B-spline basis function, Introduction to bilinear surface and ruled surface	NURBS	Curves and synthetic NURBS surface as a Industrial standard	150	Presentation, Question and Answer, Discussion., Task	Internet literature and English language	Ref. 1
6	Introduction solid representation on CAD/CAM, which are B-Rep and CSG, how to manipulate solid on CAD/CAM, introduction to entity and feature representation on CAD/CAM	Solid and Feature	Solid and Feature Model on CAD/CAM	150	Presentation, Question and Answer, Discussion., Task	Internet literature and English language	Ref. 1
7	Introduction to Scale, rotation, translation, and mirror, as a basictransformation. Introduction to concatenated transformation, Homogen coordinates, and Projection in CAD/CAM	Transformation	Transformation abd Projection, and its application on CAD/CAM	150	Presentation, Question and Answer, Discussion., Task	Internet literature and English language	Ref. 1
8	Introduction to Scale, rotation, translation, and mirror, as a basictransformation.	Transformation	Transformation and Projection, and its application on CAD/CAM	150	Presentation, Question and Answer, Discussion., Task	Internet literature and English language	Ref. 1

	transformation, Homogen coordinates, and Projection in CAD/CAM forming						
9	Introduction to hidden line and surface removal, shading model, color concept on computer graphic, kinds of animation, and animation technique	Visualization and animation	Various visualization technique and animation on computer	150	Presentation, Question and Answer, Discussion., Task	Internet literature and English language	Ref. 1
10	Introduction to geometric behavior like curves length, body area, surface area, and volume. Introduction to inertia use on CAD/CAM	Design and Product development	Geometric, Inertia, and they application on CAD/CAM	150	Presentation, Question and Answer, Discussion., Task	Internet literature and English language	Ref. 1
11	Introduction to manufactured model and manufacturing design, mating condition, manufactured loading. Inference for translational and rotational position. Method to analyze manufactured product	Manufactured modeling	Manufactured model and tree-representation. Bottom-up and top-down approach, manufactured analysis	150	Presentation, Question and Answer, Discussion., Task	Internet literature and English language	Ref. 1
12	Introduction FEM procedure, Integral equation and its development, shape, degree of freedom, shape function in FEM. Understand	Finite Element Method	FEM procedure, FEM analysis, Integral Equation, FEM modeling, and mesh generation	150	Presentation, Question and Answer, Discussion., Task	Internet literature and English language	Ref. 1

	model, and mesh method generation						
13	Introduction to conventional tolerance concept, standard concept, various geometric tolerance, Understanding tolerance application in design and manufacture	Product tolerance	Tolerance, suaian, geometric tolerance, and tolerance analysis	150	Presentation, Question and Answer, Discussion., Task	Internet literature and English language	Ref. 1
14	Knowledge application about product documentation for delivering idea about designed product. To applicate several concept of CAD/CAM technology for solving real cases in industry	Student presentation	Case studies	150	Presentation, Question and Answer, Discussion., Task	Internet literature and English language	Ref. 1

STANDARD COURSE OUTLINE

Subject : **CAD-CAM**
Subject Code : TKM
Subject Credit : 2
Class schedule : 2 x 50 minutes
Lecture : 1st

A. Course Objective
1. General Objective : Recognize CAD-CAM Sytem, 3D modeling and viewing, tools for modelling
2. Specific Objective : Recognize Life cycle product concept, CAD/Cam application, 3D modeling theory, geometry model type, modeling tools

B. Desirable student competencies:
Internet literature and English language

C. Course Method:
Presentation, Question and Answer, Discussion.

D. Main course description:
CAD/CAM system

E. Sub Course description:
Introduction to CAD/CAM system, 3D modeling and viewing, modeling tools

F. Course Activity:

No	PROGRESSION	TIME ESTIMATION	LECTURER ACTIVITY	STUDENT ACTIVITY	RESOURCES COMMONLY AVAILABLE
1	INTRODUCTION	5	Preface	Listening	LCD White board Computer
2	PRESENTATION	85	Discussion and study cases	Asking & Giving opinion	LCD White board Color marker
3	CLOSING	10	Giving course conclusion	Asking & Giving opinion	LCD White board Color marker

G. Method of assessment
Home Work, Small test, mid exam and final exam

H. Text Book
Mastering CAD/CAM, McGraw-Hill International Edition, Ibrahim Zeid, McGraw-Hill,2005

STANDARD COURSE OUTLINE

Subject : **CAD-CAM**
Subject Code : TKM
Subject Credit : 2
Class schedule : 2 x 50 minutes
Lecture : 2nd

A. Course Objective
1. General Objective : Product documentation review in all aspect in engineering drawing. Program introduction and its application on CAD/CAM
2. Specific Objective : Drawing structure, projection method, View, dimension, and tolerance review on engineering drawing. Introduction to RDBMS and Object Oriented Programming

B. Desirable student competencies:
Internet literature, Software Skill and English language

C. Course Method:
Presentation, Question and Answer, Discussion., Task

D. Main course description:
CAD/CAM programming and engineering drawing

E. Sub Course description:
Engineering drawing review and its attribute. Introduction to program and its application on CAD/CAM

F. Course Activity:

No	PROGRESSION	TIME ESTIMATION	LECTURER ACTIVITY	STUDENT ACTIVITY	RESOURCES COMMONLY AVAILABLE
1	INTRODUCTION	5	Preface	Listening	LCD White board Computer
2	PRESENTATION	85	Discussion and study cases	Asking & Giving opinion	LCD White board Color marker
3	CLOSING	10	Giving course conclusion	Asking & Giving opinion	LCD White board Color marker

G. Method of assessment
Home Work, Small test, mid exam and final exam

H. Text Book
Mastering CAD/CAM, McGraw-Hill International Edition, Ibrahim Zeid, McGraw-Hill,2005

STANDARD COURSE OUTLINE

Subject : **CAD-CAM**
Subject Code : TKM
Subject Credit : 2
Class schedule : 2 x 50 minutes
Lecture : 3rd

A. Course Objective
1. General Objective : Introduction to simple Curve and synthetic definition
Introduction to curve application on CAD/CAM Program

2. Specific Objective : Introduction to simple curve and mathematic model
Introduction to synthetic curve and mathematic model
Introduction to Hermita curve, Bezier and B-spline

B. Desirable student competencies:
Internet literature, Software Skill and English language

C. Course Method:
Presentation, Question and Answer, Discussion., Task

D. Main course description:
Curves

E. Sub Course description:
Curves Geometric model and its definitions

F. Course Activity:

No	PROGRESSION	TIME ESTIMATION	LECTURER ACTIVITY	STUDENT ACTIVITY	RESOURCES COMMONLY AVAILABLE
1	INTRODUCTION	5	Preface	Listening	LCD White board Computer
2	PRESENTATION	85	Discussion and study cases	Asking & Giving opinion	LCD White board Color marker
3	CLOSING	10	Giving course conclusion	Asking & Giving opinion	LCD White board Color marker

G. Method of assessment
Home Work, Small test, mid exam and final exam

H. Text Book
Mastering CAD/CAM, McGraw-Hill International Edition, Ibrahim Zeid, McGraw-Hill,2005

STANDARD COURSE OUTLINE

Subject : **CAD-CAM**
Subject Code : TKM
Subject Credit : 2
Class schedule : 2 x 50 minutes
Lecture : 4th

A. Course Objective
1. General Objective : Introduction to simple Curve and synthetic definition
Introduction to curve application on CAD/CAM Program

2. Specific Objective : Introduction to simple curve and mathematic model
Introduction to synthetic curve and mathematic model
Introduction to tools for surface analysis

B. Desirable student competencies:
Internet literature, Software Skill and English language

C. Course Method:
Presentation, Question and Answer, Discussion., Task

D. Main course description:
Surfaces

E. Sub Course description:
Surface Geometric model and its definitions

F. Course Activity:

No	PROGRESSION	TIME ESTIMATION	LECTURER ACTIVITY	STUDENT ACTIVITY	RESOURCES COMMONLY AVAILABLE
1	INTRODUCTION	5	Preface	Listening	LCD White board Computer
2	PRESENTATION	85	Discussion and study cases	Asking & Giving opinion	LCD White board Color marker
3	CLOSING	10	Giving course conclusion	Asking & Giving opinion	LCD White board Color marker

G. Method of assessment
Home Work, Small test, mid exam and final exam

H. Text Book
Mastering CAD/CAM, McGraw-Hill International Edition, Ibrahim Zeid, McGraw-Hill,2005

STANDARD COURSE OUTLINE

Subject : **CAD-CAM**
Subject Code : TKM
Subject Credit : 2
Class schedule : 2 x 50 minutes
Lecture : 5th

A. Course Objective
1. General Objective : Introduction to Curve and synthetic NURBS surface definition

2. Specific Objective : Introduction to Curve and synthetic NURBS surface definition, Introduction to non-uniform rational B-spline basis function, Introduction to bilinear surface and ruled surface

B. Desirable student competencies:
Internet literature, Software Skill and English language

C. Course Method:
Presentation, Question and Answer, Discussion., Task

D. Main course description:
NURBS

E. Sub Course description:
Curves and synthetic NURBS surface as a Industrial standard

F. Course Activity:

No	PROGRESSION	TIME ESTIMATION	LECTURER ACTIVITY	STUDENT ACTIVITY	RESOURCES COMMONLY AVAILABLE
1	INTRODUCTION	5	Preface	Listening	LCD White board Computer
2	PRESENTATION	85	Discussion and study cases	Asking & Giving opinion	LCD White board Color marker
3	CLOSING	10	Giving course conclusion	Asking & Giving opinion	LCD White board Color marker

G. Method of assessment
Home Work, Small test, mid exam and final exam

H. Text Book
Mastering CAD/CAM, McGraw-Hill International Edition, Ibrahim Zeid, McGraw-Hill,2005

STANDARD COURSE OUTLINE

Subject : **CAD-CAM**
Subject Code : TKM
Subject Credit : 2
Class schedule : 2 x 50 minutes
Lecture : 6th

A. Course Objective
1. General Objective : Introduction to Model as solid representation, introduction to concept and CAD/CAM application

2. Specific Objective : Introduction solid representation on CAD/CAM, which are B-Rep and CSG, how to manipulate solid on CAD/CAM, introduction to entity and feature representation on CAD/CAM

B. Desirable student competencies:
Internet literature, Software Skill and English language

C. Course Method:
Presentation, Question and Answer, Discussion., Task

D. Main course description:
Solid and Feature

E. Sub Course description:
Solid and Feature Model on CAD/CAM

F. Course Activity:

No	PROGRESSION	TIME ESTIMATION	LECTURER ACTIVITY	STUDENT ACTIVITY	RESOURCES COMMONLY AVAILABLE
1	INTRODUCTION	5	Preface	Listening	LCD White board Computer
2	PRESENTATION	85	Discussion and study cases	Asking & Giving opinion	LCD White board Color marker
3	CLOSING	10	Giving course conclusion	Asking & Giving opinion	LCD White board Color marker

G. Method of assessment
Home Work, Small test, mid exam and final exam

H. Text Book
Mastering CAD/CAM, McGraw-Hill International Edition, Ibrahim Zeid, McGraw-Hill,2005

STANDARD COURSE OUTLINE

Subject : **CAD-CAM**
Subject Code : TKM
Subject Credit : 2
Class schedule : 2 x 50 minutes
Lecture : 7th

A. Course Objective
1. General Objective : -

2. Specific Objective : -

B. Desirable student competencies:
-

C. Course Method:
Presentation, Question and Answer, Discussion., Task

D. Main course description:
Mid Exam

E. Sub Course description:
Previous Study Material

F. Course Activity:

No	PROGRESSION	TIME ESTIMATION	LECTURER ACTIVITY	STUDENT ACTIVITY	RESOURCES COMMONLY AVAILABLE
1	INTRODUCTION	5	Preface	Listening	LCD White board Computer
2	PRESENTATION	85	Discussion and study cases	Asking & Giving opinion	LCD White board Color marker
3	CLOSING	10	Giving course conclusion	Asking & Giving opinion	LCD White board Color marker

G. Method of assessment
Home Work, Small test, mid exam and final exam

H. Text Book
Mastering CAD/CAM, McGraw-Hill International Edition, Ibrahim Zeid, McGraw-Hill,2005

STANDARD COURSE OUTLINE

Subject : **CAD-CAM**
Subject Code : TKM
Subject Credit : 2
Class schedule : 2 x 50 minutes
Lecture : 8th

A. Course Objective

1. General Objective : Introduction to 2D and 3D basic transformation, Geometric model mapping, Projection, and its application

2. Specific Objective : Introduction to Scale, rotation, translation, and mirror, as a basictransformation. Introduction to concatenated transformation, Homogen coordinates, and Projection in CAD/CAM

B. Desirable student competencies:
Internet literature, Software Skill and English language

C. Course Method:
Presentation, Question and Answer, Discussion., Task

D. Main course description:
Transformation

E. Sub Course description:
Transformation abd Projection, and its application on CAD/CAM

F. Course Activity:

No	PROGRESSION	TIME ESTIMATION	LECTURER ACTIVITY	STUDENT ACTIVITY	RESOURCES COMMONLY AVAILABLE
1	INTRODUCTION	5	Preface	Listening	LCD White board Computer
2	PRESENTATION	85	Discussion and study cases	Asking & Giving opinion	LCD White board Color marker
3	CLOSING	10	Giving course conclusion	Asking & Giving opinion	LCD White board Color marker

G. Method of assessment
Home Work, Small test, mid exam and final exam

H. Text Book
Mastering CAD/CAM, McGraw-Hill International Edition, Ibrahim Zeid, McGraw-Hill,2005

STANDARD COURSE OUTLINE

Subject : **CAD-CAM**
Subject Code : TKM
Subject Credit : 2
Class schedule : 2 x 50 minutes
Lecture : 8th

A. Course Objective
1. General Objective : Introduction to 2D and 3D basic transformation, Geometric model mapping, Projection, and its application

2. Specific Objective : Introduction to Scale, rotation, translation, and mirror, as a basictransformation. Introduction to concatenated transformation, Homogen coordinates, and Projection in CAD/CAM

B. Desirable student competencies:
Internet literature, Software Skill and English language

C. Course Method:
Presentation, Question and Answer, Discussion., Task

D. Main course description:
Transformation

E. Sub Course description:
Transformation and Projection, and its application on CAD/CAM

F. Course Activity:

No	PROGRESSION	TIME ESTIMATION	LECTURER ACTIVITY	STUDENT ACTIVITY	RESOURCES COMMONLY AVAILABLE
1	INTRODUCTION	5	Preface	Listening	LCD White board Computer
2	PRESENTATION	85	Discussion and study cases	Asking & Giving opinion	LCD White board Color marker
3	CLOSING	10	Giving course conclusion	Asking & Giving opinion	LCD White board Color marker

G. Method of assessment
Home Work, Small test, mid exam and final exam

H. Text Book
Mastering CAD/CAM, McGraw-Hill International Edition, Ibrahim Zeid, McGraw-Hill,2005

STANDARD COURSE OUTLINE

Subject : **CAD-CAM**
Subject Code : TKM
Subject Credit : 2
Class schedule : 2 x 50 minutes
Lecture : 9th

A. Course Objective
1. General Objective : Introduction to 3D model visualization technique and stage arrangement. Introduction to animation technique and concept on CAD/CAM

2. Specific Objective : Introduction to hidden line and surface removal, shading model, color concept on computer graphic, kinds of animation, and animation technique

B. Desirable student competencies:
Internet literature, Software Skill and English language

C. Course Method:
Presentation, Question and Answer, Discussion., Task

D. Main course description:
Visualization and animation

E. Sub Course description:
Various visualization technique and animation on computer

F. Course Activity:

No	PROGRESSION	TIME ESTIMATION	LECTURER ACTIVITY	STUDENT ACTIVITY	RESOURCES COMMONLY AVAILABLE
1	INTRODUCTION	5	Preface	Listening	LCD White board Computer
2	PRESENTATION	85	Discussion and study cases	Asking & Giving opinion	LCD White board Color marker
3	CLOSING	10	Giving course conclusion	Asking & Giving opinion	LCD White board Color marker

G. Method of assessment
Home Work, Small test, mid exam and final exam

H. Text Book
Mastering CAD/CAM, McGraw-Hill International Edition, Ibrahim Zeid, McGraw-Hill,2005

STANDARD COURSE OUTLINE

Subject : **CAD-CAM**
Subject Code : TKM
Subject Credit : 2
Class schedule : 2 x 50 minutes
Lecture : 10^{th}

A. Course Objective
1. General Objective : Introduction to gometric and inertia behavior concept, they technique and application on CAD/CAM

2. Specific Objective : Introduction to geometric behavior like curves length, body area, surface area, and volume. Introduction to inertia use on CAD/CAM

B. Desirable student competencies:
Internet literature, Software Skill and English language
C. Course Method:
Presentation, Question and Answer, Discussion., Task
D. Main course description:
Design and Product development
E. Sub Course description:
Geometric, Inertia, and they application on CAD/CAM
F. Course Activity:

No	PROGRESSION	TIME ESTIMATION	LECTURER ACTIVITY	STUDENT ACTIVITY	RESOURCES COMMONLY AVAILABLE
1	INTRODUCTION	5	Preface	Listening	LCD White board Computer
2	PRESENTATION	85	Discussion and study cases	Asking & Giving opinion	LCD White board Color marker
3	CLOSING	10	Giving course conclusion	Asking & Giving opinion	LCD White board Color marker

G. Method of assessment
Home Work, Small test, mid exam and final exam
H. Text Book
Mastering CAD/CAM, McGraw-Hill International Edition, Ibrahim Zeid, McGraw-Hill,2005

STANDARD COURSE OUTLINE

Subject : **CAD-CAM**
Subject Code : TKM
Subject Credit : 2
Class schedule : 2 x 50 minutes
Lecture : 11th

A. Course Objective

1. General Objective : Introduction to manufactured model and tree representation which can be used on CAD/CAM. Introduction to manufacturing approach based on bottom-up and top-down. And method to analyze manufactured product

2. Specific Objective : Introduction to manufactured model and manufacturing design, mating condition, manufactured loading. Inference for translational and rotational position. Method to analyze manufactured product

B. Desirable student competencies:
Internet literature, Software Skill and English language

C. Course Method:
Presentation, Question and Answer, Discussion., Task

D. Main course description:
Manufactured modeling

E. Sub Course description:
Manufactured model and tree-representation. Bottom-up and top-down approach, manufactured analysis

F. Course Activity:

No	PROGRESSION	TIME ESTIMATION	LECTURER ACTIVITY	STUDENT ACTIVITY	RESOURCES COMMONLY AVAILABLE
1	INTRODUCTION	5	Preface	Listening	LCD White board Computer
2	PRESENTATION	85	Discussion and study cases	Asking & Giving opinion	LCD White board Color marker
3	CLOSING	10	Giving course conclusion	Asking & Giving opinion	LCD White board Color marker

G. Method of assessment
Home Work, Small test, mid exam and final exam

H. Text Book
Mastering CAD/CAM, McGraw-Hill International Edition, Ibrahim Zeid, McGraw-Hill,2005

STANDARD COURSE OUTLINE

Subject : **CAD-CAM**
Subject Code : TKM
Subject Credit : 2
Class schedule : 2 x 50 minutes
Lecture : 12th

A. Course Objective

1. General Objective : Introduction to FEM as a method in product design, and procedure in FEM

2. Specific Objective : Introduction FEM procedure, Integral equation and its development, shape, degree of freedom, shape function in FEM. Understand boundary condition and loading in FEM model, and mesh method generation

B. Desirable student competencies:
Internet literature, Software Skill and English language

C. Course Method:
Presentation, Question and Answer, Discussion., Task

D. Main course description:
Finite Element Method

E. Sub Course description:
FEM procedure, FEM analysis, Integral Equation, FEM modeling, and mesh generation

F. Course Activity:

No	PROGRESSION	TIME ESTIMATION	LECTURER ACTIVITY	STUDENT ACTIVITY	RESOURCES COMMONLY AVAILABLE
1	INTRODUCTION	5	Preface	Listening	LCD White board Computer
2	PRESENTATION	85	Discussion and study cases	Asking & Giving opinion	LCD White board Color marker
3	CLOSING	10	Giving course conclusion	Asking & Giving opinion	LCD White board Color marker

G. Method of assessment
Home Work, Small test, mid exam and final exam

H. Text Book
Mastering CAD/CAM, McGraw-Hill International Edition, Ibrahim Zeid, McGraw-Hill,2005

STANDARD COURSE OUTLINE

Subject : **CAD-CAM**
Subject Code : TKM
Subject Credit : 2
Class schedule : 2 x 50 minutes
Lecture : 13th

A. Course Objective

1. General Objective : Introduction to tolerance, tolerance concept, concept and technique for tolerance application on CAD/CAM

2. Specific Objective : Introduction to conventional tolerance concept, standard concept, various geometric tolerance, Understanding tolerance application in design and manufacture

B. Desirable student competencies:
Internet literature, Software Skill and English language

C. Course Method:
Presentation, Question and Answer, Discussion., Task

D. Main course description:
Product tolerance

E. Sub Course description:
Tolerance, suaian, geometric tolerance, and tolerance analysis

F. Course Activity:

No	PROGRESSION	TIME ESTIMATION	LECTURER ACTIVITY	STUDENT ACTIVITY	RESOURCES COMMONLY AVAILABLE
1	INTRODUCTION	5	Preface	Listening	LCD White board Computer
2	PRESENTATION	85	Discussion and study cases	Asking & Giving opinion	LCD White board Color marker
3	CLOSING	10	Giving course conclusion	Asking & Giving opinion	LCD White board Color marker

G. Method of assessment
Home Work, Small test, mid exam and final exam

H. Text Book
Mastering CAD/CAM, McGraw-Hill International Edition, Ibrahim Zeid, McGraw-Hill,2005

STANDARD COURSE OUTLINE

Subject : **CAD-CAM**
Subject Code : TKM
Subject Credit : 2
Class schedule : 2 x 50 minutes
Lecture : 14th

A. Course Objective
1. General Objective : Method and concept implementation of CAD/CAM in real cases

2. Specific Objective : Knowledge application about product documentation for delivering idea about designed product. To applicate several concept of CAD/CAM technology for solving real cases in industry

B. Desirable student competencies:
Internet literature, Software Skill and English language

C. Course Method:
Presentation, Question and Answer, Discussion., Task

D. Main course description:
Student presentation

E. Sub Course description:
Case studies

F. Course Activity:

No	PROGRESSION	TIME ESTIMATION	LECTURER ACTIVITY	STUDENT ACTIVITY	RESOURCES COMMONLY AVAILABLE
1	INTRODUCTION	5	Preface	Listening	LCD White board Computer
2	PRESENTATION	85	Discussion and study cases	Asking & Giving opinion	LCD White board Color marker
3	CLOSING	10	Giving course conclusion	Asking & Giving opinion	LCD White board Color marker

G. Method of assessment
Home Work, Small test, mid exam and final exam

H. Text Book
Mastering CAD/CAM, McGraw-Hill International Edition, Ibrahim Zeid, McGraw-Hill,2005

STANDARD COURSE OUTLINE

Subject : **CAD-CAM**
Subject Code : TKM
Subject Credit : 2
Class schedule : 2 x 50 minutes
Lecture : 15th

A. Course Objective
1. General Objective : Method and concept implementation of CAD/CAM in real cases

2. Specific Objective : Knowledge application about product documentation for delivering idea about designed product. To applicate several concept of CAD/CAM technology for solving real cases in industry

B. Desirable student competencies:
Internet literature, Software Skill and English language

C. Course Method:
Presentation, Question and Answer, Discussion., Task

D. Main course description:
Student presentation

E. Sub Course description:
Case studies

F. Course Activity:

No	PROGRESSION	TIME ESTIMATION	LECTURER ACTIVITY	STUDENT ACTIVITY	RESOURCES COMMONLY AVAILABLE
1	INTRODUCTION	5	Preface	Listening	LCD White board Computer
2	PRESENTATION	85	Discussion and study cases	Asking & Giving opinion	LCD White board Color marker
3	CLOSING	10	Giving course conclusion	Asking & Giving opinion	LCD White board Color marker

G. Method of assessment
Home Work, Small test, mid exam and final exam

H. Text Book
Mastering CAD/CAM, McGraw-Hill International Edition, Ibrahim Zeid, McGraw-Hill,2005

STANDARD COURSE OUTLINE

Subject : **CAD-CAM**
Subject Code : TKM
Subject Credit : 2
Class schedule : 2 x 50 minutes
Lecture : 16th

A. Course Objective
1. General Objective : Method and concept implementation of CAD/CAM in real cases

2. Specific Objective : Knowledge application about product documentation for delivering idea about designed product. To applicate several concept of CAD/CAM technology for solving real cases in industry

B. Desirable student competencies:
Internet literature, Software Skill and English language

C. Course Method:
Presentation, Question and Answer, Discussion., Task

D. Main course description:
Student presentation

E. Sub Course description:
Case studies

F. Course Activity:

No	PROGRESSION	TIME ESTIMATION	LECTURER ACTIVITY	STUDENT ACTIVITY	RESOURCES COMMONLY AVAILABLE
1	INTRODUCTION	5	Preface	Listening	LCD White board Computer
2	PRESENTATION	85	Discussion and study cases	Asking & Giving opinion	LCD White board Color marker
3	CLOSING	10	Giving course conclusion	Asking & Giving opinion	LCD White board Color marker

G. Method of assessment
Home Work, Small test, mid exam and final exam

H. Text Book
Mastering CAD/CAM, McGraw-Hill International Edition, Ibrahim Zeid, McGraw-Hill,2005

GARIS-GARIS PROGRAM PEMBELAJARAN

SUBJECTS TITLE	: Engineering Mechanics and Entrepreneurship
SUBJECTS CODE	: TKM 324
SEMESTER CREDITS UNIT	: 3 SCU

BRIEF DESCRIPTION : In doing economic evaluation toward proposal or project that have technical characteristic need analysis method. The analysis consist methods that no need consider to interest rate (just to see existing variable, material selection etc). Another method is equivalency and stepping returns method. The method is use to analyze whether single proposal or to determine the best proposal from several alternative and able to use either to evaluate small project whether big or small scale.

GENERAL COURSE OBJ. : Students understand the basics economic consideration to evaluate engineering proposal that relevance with financial cash flow, equivalence concept, alternative comparison indicators, and decision making criteria and able to apply on planning and project control.

No	COURSE OBJECTIVES	MAIN COURSE DESCRIPTION	SUB COURSE DESCRIPTION	TIME ESTIMATE	TEXTBOOK
1	Being giving general image about the subjects, students majoring mechanical engineering 6th semester expected can give objective, benefit and class learning process minimum 80% correct.	Introduction	- T IU - Re levance - C ourse Contract Explanation - C ollege Principle and - Procedure Assignment - Ex planation Task Explanation and Grades	150 minute	
	If given the material about basic concept of Engineering Economics and Entrepreneurship, students majoring mechanical engineering 6th semester expected can explain basic concept of Engineering Economics and Entrepreneurship.	Engineering Economic Concept and Entrepreneurship	- Mana gement Definition and Engineering Accountancy - Pro ject and Functional Management		1,2,3
2	If given the material about Project Activity Behavior, students majoring mechanical engineering 6th semester expected can explain and compare between project activity and operational activity.	Project Activity Behavior	- Pro ject Target and Triple Constrain - Pro ject Activity and Operational Comparison	150 minute	1,2,3
3	If given the material about engineering economics decision process, students majoring mechanical engineering 6th semester expected can apply this decision making is minimum 80% correct.	Engineering Economic Decision Making Procedure	- G eneral Decision Making Procedure - Engineerin g Decision Making Procedure - C ost Concept as Engineering Economic View	150 minute	1,2,3
4	If given the material about accountancy basic principle, students majoring mechanical engineering 6th semester expected can apply to make financial report as a material to decision-making process.	Accountancy Basic Principles	- Profit -Loss Report - Ca sh Balance - C ost Accountancy - Ca sh Ratio - Profita bility Ratio	150 minute	1,2,3
5	If given the material about financial aspect, students majoring mechanical engineering 8th semester expected can apply to know inside and outside cash flow from corporation minimum 80% correct.	Financial Aspect	- Earn ing - Profit Analysis and Break Even Point - Break E ven Point Calculation - Pro ject Cash Flow Component - Pro ject Investment Selection Criteria		
6	If given midterm, students majoring mechanical engineering 8th semester expected can evaluate about the subjects minimum 80% correct.	Mid Test		150 minute	1,2,3

7	If given the material about interest rate and interest rate equation, students majoring mechanical engineering 8th semester expected can predict currency value in the future minimum 80% correct.	Interest Rate and Interest Rate Equation	- Cu rrency Value Time to time - S imple Interest - C omplex Interest - In terest influence Factors	2 x 150 minute	1,2,3
8	If given the material about investment stepping return concept, students majoring mechanical engineering 8th semester expected can predict whether the investment is making a profit or not minimum 80% correct..	Investment Stepping Return Concept	- MA RR - Ca pital Recovery - Pa yback Periods - Re turn Of Investment	2 x 150 minute	1,2,3
9	If given the material about project planning engineering, students majoring mechanical engineering 8th semester expected can apply it minimum 80% correct.	Project Planning Engineering	- Crit ical Path Method - Crit ical Path Identification - Pro ject Activity Calculation Case Samples	150 minute	1,2,3
10	If given the material about depreciation, students majoring mechanical engineering 8th semester expected can predict assets value or property from a company with that result can predict the business stability in the future.	Depreciation	- Depreci ation Accounting - Ba sic Depreciation Calculation - Depreci ation Method - Depreci ation Method Comparison	2 x 150 minute	1,2,3
11	If given the material about inflation and deflation, students majoring mechanical engineering 8th semester expected can calculate the rate of inflation and able to predict the step that can be take to deal the inflation minimum 80% correct.	Inflation and Deflation	- I nflation Category - Inflati on Handling Method - Deflat ion	2 x 150 minute	1,2,3
12	If given final test, students majoring mechanical engineering 8th semester expected can evaluate about the subjects minimum 80% correct.	Final Test		150 minute	1,2,3

SATUAN ACARA PEMBELAJARAN

SUBJECTS TITLE : Engineering Economics and Entrepreneurship
SUBJECTS CODE : TKM 324
SEMESTER CREDIT UNITS : 3 SCU
WAKTU PERTEMUAN : 3 x 50 minute
LECTURE : 1 (First)

A. COURSE OBJECTIVES
   1. GENERAL OBJECTIVES
   2. SPECIFIC OBJECTIVE : Being giving general image about treatment management, students majoring mechanical engineering 6th semester expected can give objective, benefit and class learning process minimum 80% correct.

B. KEMAMPUAN SOFTSKILL
C. METODA PEMBELAJARAN
D. MAIN COURSE DESCRIPTION : Introduction

E. SUB COURSE DESCRIPTION : TIU
   Relevance
   Course Contract Explanation
   College Principle and Procedure
   Assignment Explanation
   Task Explanation and Grades

F. COURSE ACTIVITY

NO	STAGES	TIME ESTIMATE	LECTURER	STUDENT ACTIVITY	RESOURCES COMMONLY AVAILABLE
1	INTRODUCTION		1. Explain purpose of studying Engineering Economics and Entrepreneurship 2. Explain benefit of studying Engineering Economics and Entrepreneurship 3. Explain competence in TIU and TIK for first meeting	Pay attention	LCD White Board
2	PRESENTATION		4. Explains : 1. Subjects relevance between Engineering Economics and Entrepreneurship with other subjects 2. Course contract Explanation 3. Course Principle and Procedure 4. Assignment Explanation 5. Task Explanation and Grades	Do or give suggestion	LCD White Board
3	CLOSING		1. Summarize the syllabus 2. Give question 3. Give general objectives image about next subjects	Pay attention Question and Answer	LCD White Board

G. METHODS OF ASSESSMENT : Asking to a students randomly about today syllabus

H. TEXTBOOK: 1. Eugene L.G, W. Grant Ireson, *Dasar-dasar Ekonomi Teknik*, Bina Aksara, Jakarta, 1987
2. I Nyoman Pujawan, Ekonomi Teknik, Guna Widya, Surabaya 2003
3. Iman Suharlto, Manajemen Proyek, Erlangga, Jakarta, 1999

GARIS-GARIS BESAR PROGRAM PEMBELAJARAN

SUBJECTS TITLE : Mechanical Fluids and Positive Displacement
SUBJECTS CODE : TKM ..../ 2 SKS / VI
BRIEF DESCRIPTION : 325
GENERAL COURSE OBJECTIVES : After following this class, students is expected to understand and able to explain basics law, characteristic and selection and planning fluid engine, and engine that working based "positive displacement"

No	COURSE OBJECTIVES	MAIN COURSE DESCRIPTION	SUB COURSE DESCRIPTION	TIME ESTIMATE	COURSE METHOD	DESIRABLE STUDENT COMPETENCY	TEXTBOOK
1	• Able to explain fluids engine principle • Able to apply Bernoulli equation • Able to explain head and pump specific work • Able to explain various loss • Able to explain notation on fluids engine • Able to explain basic phenomenon on fluids engine and explain Euler equation derivation	• Introduction • Basic equation • Losses and efficiency • Use notation on fluid engine • Velocity triangle and Euler equation		90	Presentation and discussion	Able to present opinion	Book one and Book two
2	Able to explain: ▪ Influence space between blades, blades amount ▪ Comparison between one dimensional potential flow and real flow on axial blade ▪ Space pressure, reaction degree, pressure number, and numbers	Influence space between blades, blades amount and friction Comparison between one dimensional potential flow and real flow on axial blade		90	Presentation and discussion	Able to present opinion	Book one and Book two

		Space pressure, reaction degree, pressure number, and numbers					
3	▪ Able to explain various type blades use ▪ Able to explain specific velocity ▪ Able to explain blades type and the losses base on specific velocity	1. Various blades type and its use ▪ Specific velocity 2. Blades type based specific velocity ▪ Losses on fluid engine based specific velocity		90	Presentation and discussion	Able to present opinion	Book one and Book two
4	Able to choose pump base on operation stability Able to determine optimum pump working area	▪ Pump characteristic ▪ System characteristic		90	Presentation and discussion	Able to present opinion Mampu mengutarakan pendapat	Book one and Book two
5	▪ Able to apply uniformity law ▪ Able to explain pump construction sample	▪ Pump uniformity law ▪ Pump construction sample		90	Presentation and discussion	Able to present opinion Mampu mengutarakan pendapat	Book one and Book two
6	▪ Able to explain cavitations phenomenon ▪ Able to avoid and decrease cavitations on a pump	▪ Pump cavitations ▪ $NPSH_A$ and $NPSH_R$		90	Presentation and discussion	Able to present opinion Mampu mengutarakan pendapat	Book one and Book two
7	Able to calculate and design radial pump	▪ Radial pump design calculation		90	Presentation and discussion	Able to present opinion Mampu mengutarakan pendapat	Book one and Book two

8	Able to calculate and design radial pump	▪ Radial pump design calculation		90	Presentation and discussion	Able to present opinion Mampu mengutarakan pendapat	Book one and Book two
9	Able to explain turbine Able to explain turbine characteristic	Turbine type base specific velocity Turbine characteristic Turbine construction sample		90	Presentation and discussion	Able to present opinion Mampu mengutarakan pendapat	Book one and Book two
10	Understand basic theory hydrodynamic flow Able to explain water turbine types and cavitations on water turbine	Water turbine: ▪ Basic theory hydrodynamic flow ▪ Water turbine type ▪ Cavitations on water turbine		90			Book one and Book two
11	Able to explain thermal fluid engine working principle Explain fans working area, blower, and centrifugal compressor	▪ Thermal fluid engine ▪ Fans, blower and centrifugal pump		90	Presentation and discussion	Able to present opinion Mampu mengutarakan pendapat	Book one and Book two
12	Able to explain: 1. Pressure level 2. Velocity level 3. Equal steam turbine pressure	Steam turbine: Pressure level Velocity level Equal pressure steam		90	Presentation and discussion	Able to present opinion Mampu mengutarakan pendapat	Book one and Book two
13	Able to explain: ▪ Equal pressure steam turbine shape and more ▪ Steam turbine control, steam turbine limitations	Steam turbine: ▪ Equal pressure steam turbine shape and more		90	Presentation and discussion	Able to present opinion Mampu mengutarakan pendapat	Book one and Book two

		▪ Steam turbine limitations ▪ Phase steam turbine					
14	Able to explain: Use and working principle open cycle Open cycle with a heater	Gas turbine: Use and working principle chapter Open cycle chapter Open cycle with heater		90	Presentation and discussion	Able to present opinion	Book one and Book two
15	▪ Understand closed gas turbine installation and gas turbine and steam combination ▪ Explain phenomenon and hydraulic clutch characteristic	Gas turbine: ▪ Closed cycle gas turbine installation ▪ Gas combination installation and gas turbine for airplane engine ▪ Steam turbine windmill hydraulic clutch		90	Presentation and discussion	Able to present opinion Mampu mengutarakan pendapat	Book one and Book two
16	• Understand and know working principle and characteristic piston pump, piston compressor, screw pump and screw compressor	Pump and compressor "positive displacement" : 		90	Presentation and discussion	Able to present opinion Mampu mengutarakan pendapat	Book three

Textbook :

Obligation : 1. Turbin Pompa dan Kompresor, Frietz Dietsel Erlangga, 1988.

Suggestion : 2. Stroemungsmaschinen, Pfleidere/Petermann, Springer-Verlag, 1972

3. Pompa dan Kompresor, Sularso, PT Pradnya Paramita, 1985

SATUAN ACARA PEMBELAJARAN (SAP)

SUBJECTS TITLE	:	Mechanical Fluids and Positive Displacement
SUBJECTS CODE	:	TKM ..../ 2 SKS / VI
SEMESTER CREDIT UNITS	:	2
CLASS/LABORATORY SCHEDULE	:	90 menit per pertemuan
LECTURE	:	1 sampai 16

A. COURSE OBJECTIVES

1. GENERAL OBJECTIVES : see GBPP second column

2. SPECIFIC OBJECTIVE : see GBPP first column

B. DESIRABLE STUDENT COMPETENCY : Able to present opinion
Mampu mengutarakan pendapat

C. COURSE METHOD : Presentation and discussion

D. MAIN COURSE DESCRIPTION : see GBPP second column

E. SUB COURSE DESCRIPTION :

F. COURSE ACTIVITY

NO	STAGES	TIME ESTIMATE	LECTURER	STUDENT ACTIVITY	RESOURCES COMMONLY AVAILABLE
1	INTRODUCTION	10	Repeat last lecture	Answer quiz or answer the question from lecturer	LCD
2	PRESENTATION	70	Lecturer give syllabus	Listen and discussion	LCD
3	CLOSING	10	Lecturer resume syllabus		LCD

G.	METHODS OF ASSESSMENT	:			
H.	TEXTBOOK	:	Obligation	:	1. Turbin Pompa dan Kompresor, Frietz Dietsel Erlangga, 1988.
			Suggestion	:	2. Stroemungsmaschinen, Pfleidere/Petermann, Springer-Verlag, 1972
					3. Pompa dan Kompresor, Sularso, PT Pradnya Paramita, 1985

SUBJECT TITLE	**Measurement System**
SUBJECT CODE / CREDITS	TKM328 / 2
SEMESTER	VI
BRIEF DESCRIPTION	This subject is include in main subject of mechanical engineering
GENERAL COURSE OBJECTIVES	Student will have knowledge of measurement which related with engineering field

WEEK	SPECIFIC OBJECTIVE	MAIN COURSE DESCRIPTION	SUB COURSE DESCRIPTION	TIME ESTIMATE (minute)	COURSE METHOD	SOFT SKILL STUDENT COMPETENCY	REFERENCE
1	Student will learn measuring technique and types of error in measuring	Introduction, static performance characteristics	Classification of transducers, methods of correction, sources of error, accuracy and precision, sensitivity, nonlinearity, propagation of error, impedance matching	90	Kuliah	Students will have high motivation for studying measurement systems	1 & 2
2	Student will learn mathematical modelling measuring device	Dynamic performance characteristics	Complex numbers, 1st order systems, 2nd order systems, transfer function, frequency response plot	90	Kuliah	Student will have good analysis and will able to explain dynamical measurement instrumentation in professional communicationn	1 & 2
3	Student will have knowledge of vibration measuring equipment and application	Acceleration and vibration measurement 1	Seismic and accelerometer model	90	Kuliah	Student will have good analysis and will able to explain dynamical measurement instrumentation in professional communicationn	1 & 2
4	Student will have knowledge of vibration measuring equipment and application	Acceleration and vibration measurement 2	Seismic and accelerometer characteristics, vibration signals	90	Kuliah	Student will have good analysis and will able to explain dynamical measurement instrumentation in professional communicationn	1 & 2
5	Student will understand and have knowledge of computer software for measuring experiment	Digital data acquisition dan signal conditioning	Filter, effect of sampling rate, resolution, wire connection, spectral analysis, LabView	90	Kuliah	Student will have good analysis and will able to explain dynamical measurement instrumentation in professional communicationn	1 & 2
6	Student are able to solve equation of mathematical modelling	Review for midterm exam	Review dari kuliah 1 sd kuliah 5, latihan soal, contoh soal	90	Kuliah	Student will have good analysis and will able to explain dynamical measurement instrumentation in professional communicationn	1 & 2
7		Midterm exam		90	Ujian		
8	Student are able to applies measurement device for kinetic and displacement	Motion and displacement measurement	Type and selection of transducers. Work principles	90	Kuliah	Student will have good analysis and will able to explain dynamical measurement instrumentation in professional communicationn	1 & 2

9	Student are able to applies force, torsion, and strain measuring device	Force, torque and strain measurement	Type and selection of transducers. Work principles	90	Kuliah	Student will have good analysis and will able to explain dynamical measurement instrumentation in professional communicationn	1 & 2
10	Student are able to applies force and sound measuring device	Pressure and sound measurement	Type and selection of transducers. Work principles	90	Kuliah	Student will have good analysis and will able to explain dynamical measurement instrumentation in professional communicationn	1 & 2
11	Student are able to applies flow measuring device	Flow measurement	Type and selection of transducers. Work principles	90	Kuliah	Student will have good analysis and will able to explain dynamical measurement instrumentation in professional communicationn	1 & 2
12	Student are able to applies temperature measuring device	Temperature measurement	Type and selection of transducers. Work principles	90	Kuliah	Student will have good analysis and will able to explain dynamical measurement instrumentation in professional communicationn	1 & 2
13	Student are able to select measuring device effectivelly	Review for final exam	Review dari kuliah satu semester, latihan soal, contoh soal	90	Kuliah	Student will have good analysis and will able to explain dynamical measurement instrumentation in professional communicationn	1 & 2
14		Final exam		90	Ujian		

Pustaka

1. James W. Dally et. Al, "Instrumentation for Engineering Measurement", John Wiley & Son, 2nd ed
2. Ernest O. Doebelin. "Measurement Systems Application and Design", McGraw-Hilll, 4th ed

TKM 328 : MEASUREMENT SYSTEMS (2 CREDITS)

CLASS/LABORATORY SCHEDULE	One 90-minute lectures per week
LECTURE	1

A. COURSE OBJECTIVES

1. GENERAL OBJECTIVES	Students will learn mathematical modelling of dynamical measurement instrumentation
2. SPECIFIC OBJECTIVE	Student will learn measuring technique and types of error in measuring
B. SOFT SKILL STUDENT COMPETENCY :	Student will have good analysis and will able to explain dynamical measurement instrumentation in professional communication
C. COURSE METHOD	Teoretical Lectures, presentation and class discussion
D. MAIN COURSE DESCRIPTION	Introduction, static performance characteristics
E. SUB COURSE DESCRIPTION	Classification of transducers, methods of correction, sources of error, accuracy and precision, sensitivity, nonlinearity, propagation of error, impedance matching

F. COURSE ACTIVITY

NO	OVERVIEW	TIME ESTIMATE	CLASS ACTIVITY	STUDENT ACTIVITY	COURSE EQUIPMENT
1	INTRODUCTION	10	Presentation+discussion	Listening, reading, writing and asking	LCD Projector+Laptop
2	MAIN LECTURE	70	Presentation+discussion	Listening, reading, writing and asking	LCD Projector+Laptop
3	CONCLUSION	10	Presentation+discussion	Listening, reading, writing and asking	LCD Projector+Laptop

G. METHODS OF ASSESSMENT :

Random Quiz 10%
Homework 20 %
Midterm exam 30 %
Special Group Project 10%
Final exam 30 %

H. TEXTBOOK

1. James W. Dally et. Al, "Instrumentation for Engineering Measurement", John Wiley & Son, 2nd ed
2. Ernest O. Doebelin. "Measurement Systems Application and Design", McGraw-Hilll, 4th ed

TKM 328 : MEASUREMENT SYSTEMS (2 CREDITS)

CLASS/LABORATORY SCHEDULE — One 90-minute lectures per week
LECTURE — 2

A. COURSE OBJECTIVES
1. GENERAL OBJECTIVES — Students will learn mathematical modelling of dynamical measurement instrumentation
2. SPECIFIC OBJECTIVE — Student will learn mathematical modelling measuring device

B. SOFT SKILL STUDENT COMPETENCY : Student will have good analysis and will able to explain dynamical measurement instrumentation in professional communication

C. COURSE METHOD — Teoretical Lectures, presentation and class discussion

D. MAIN COURSE DESCRIPTION — Dynamic performance characteristics

E. SUB COURSE DESCRIPTION — Classification of transducers, methods of correction, sources of error, accuracy and precision, sensitivity, nonlinearity, propagation of error, impedance matching

F. COURSE ACTIVITY

NO	OVERVIEW	TIME ESTIMATE	CLASS ACTIVITY	STUDENT ACTIVITY	COURSE EQUIPMENT
1	INTRODUCTION	10	Presentation+discussion	Listening, reading, writing and asking	LCD Projector+Laptop
2	MAIN LECTURE	70	Presentation+discussion	Listening, reading, writing and asking	LCD Projector+Laptop
3	CONCLUSION	10	Presentation+discussion	Listening, reading, writing and asking	LCD Projector+Laptop

G. METHODS OF ASSESSMENT :
- Random Quiz 10%
- Homework 20 %
- Midterm exam 30 %
- Special Group Project 10%
- Final exam 30 %

H. TEXTBOOK

1. James W. Dally et. Al, "Instrumentation for Engineering Measurement", John Wiley & Son, 2nd ed
2. Ernest O. Doebelin. "Measurement Systems Application and Design", McGraw-Hilll, 4th ed

TKM 328 : MEASUREMENT SYSTEMS (2 CREDITS)

CLASS/LABORATORY SCHEDULE — One 90-minute lectures per week
LECTURE — 3

A. COURSE OBJECTIVES
1. GENERAL OBJECTIVES — Students will learn mathematical modelling of dynamical measurement instrumentation
2. SPECIFIC OBJECTIVE — Student will have knowledge of vibration measuring equipment and application

B. SOFT SKILL STUDENT COMPETENCY : Student will have good analysis and will able to explain dynamical measurement instrumentation in professional communication

C. COURSE METHOD — Teoretical Lectures, presentation and class discussion

D. MAIN COURSE DESCRIPTION — Acceleration and vibration measurement 1

E. SUB COURSE DESCRIPTION — Classification of transducers, methods of correction, sources of error, accuracy and precision, sensitivity, nonlinearity, propagation of error, impedance matching

F. COURSE ACTIVITY

NO	OVERVIEW	TIME ESTIMATE	CLASS ACTIVITY	STUDENT ACTIVITY	COURSE EQUIPMENT
1	INTRODUCTION	10	Presentation+discussion	Listening, reading, writing and asking	LCD Projector+Laptop
2	MAIN LECTURE	70	Presentation+discussion	Listening, reading, writing and asking	LCD Projector+Laptop
3	CONCLUSION	10	Presentation+discussion	Listening, reading, writing and asking	LCD Projector+Laptop

G. METHODS OF ASSESSMENT :

Random Quiz 10%
Homework 20 %
Midterm exam 30 %
Special Group Project 10%
Final exam 30 %

H. TEXTBOOK

1. James W. Dally et. Al, "Instrumentation for Engineering Measurement", John Wiley & Son, 2nd ed
2. Ernest O. Doebelin. "Measurement Systems Application and Design", McGraw-Hilll, 4th ed

TKM 328 : MEASUREMENT SYSTEMS (2 CREDITS)

CLASS/LABORATORY SCHEDULE — One 90-minute lectures per week
LECTURE — 4

A. COURSE OBJECTIVES
1. GENERAL OBJECTIVES — Students will learn mathematical modelling of dynamical measurement instrumentation
2. SPECIFIC OBJECTIVE — Student will have knowledge of vibration measuring equipment and application

B. SOFT SKILL STUDENT COMPETENCY : — Student will have good analysis and will able to explain dynamical measurement instrumentation in professional communication

C. COURSE METHOD — Teoretical Lectures, presentation and class discussion

D. MAIN COURSE DESCRIPTION — Acceleration and vibration measurement 2

E. SUB COURSE DESCRIPTION — Classification of transducers, methods of correction, sources of error, accuracy and precision, sensitivity, nonlinearity, propagation of error, impedance matching

F. COURSE ACTIVITY

NO	OVERVIEW	TIME ESTIMATE	CLASS ACTIVITY	STUDENT ACTIVITY	COURSE EQUIPMENT
1	INTRODUCTION	10	Presentation+discussion	Listening, reading, writing and asking	LCD Projector+Laptop
2	MAIN LECTURE	70	Presentation+discussion	Listening, reading, writing and asking	LCD Projector+Laptop
3	CONCLUSION	10	Presentation+discussion	Listening, reading, writing and asking	LCD Projector+Laptop

G. METHODS OF ASSESSMENT :

Random Quiz 10%
Homework 20 %
Midterm exam 30 %
Special Group Project 10%
Final exam 30 %

H. TEXTBOOK

1. James W. Dally et. Al, "Instrumentation for Engineering Measurement", John Wiley & Son, 2nd ed
2. Ernest O. Doebelin. "Measurement Systems Application and Design", McGraw-Hilll, 4th ed

TKM 328 : MEASUREMENT SYSTEMS (2 CREDITS)

CLASS/LABORATORY SCHEDULE — One 90-minute lectures per week
LECTURE — 5

A. COURSE OBJECTIVES
1. GENERAL OBJECTIVES — Students will learn mathematical modelling of dynamical measurement instrumentation
2. SPECIFIC OBJECTIVE — Student will understand and have knowledge of computer software for measuring experiment

B. SOFT SKILL STUDENT COMPETENCY : Student will have good analysis and will able to explain dynamical measurement instrumentation in professional communication

C. COURSE METHOD — Teoretical Lectures, presentation and class discussion

D. MAIN COURSE DESCRIPTION — Digital data acquisition dan signal conditioning

E. SUB COURSE DESCRIPTION — Classification of transducers, methods of correction, sources of error, accuracy and precision, sensitivity, nonlinearity, propagation of error, impedance matching

F. COURSE ACTIVITY

NO	OVERVIEW	TIME ESTIMATE	CLASS ACTIVITY	STUDENT ACTIVITY	COURSE EQUIPMENT
1	INTRODUCTION	10	Presentation+discussion	Listening, reading, writing and asking	LCD Projector+Laptop
2	MAIN LECTURE	70	Presentation+discussion	Listening, reading, writing and asking	LCD Projector+Laptop
3	CONCLUSION	10	Presentation+discussion	Listening, reading, writing and asking	LCD Projector+Laptop

G. METHODS OF ASSESSMENT :

Random Quiz 10%
Homework 20 %
Midterm exam 30 %
Special Group Project 10%
Final exam 30 %

H. TEXTBOOK

1. James W. Dally et. Al, "Instrumentation for Engineering Measurement", John Wiley & Son, 2nd ed
2. Ernest O. Doebelin. "Measurement Systems Application and Design", McGraw-Hilll, 4th ed

TKM 328 : MEASUREMENT SYSTEMS (2 CREDITS)

CLASS/LABORATORY SCHEDULE — One 90-minute lectures per week
LECTURE — 6

A. COURSE OBJECTIVES
1. GENERAL OBJECTIVES — Students will learn mathematical modelling of dynamical measurement instrumentation
2. SPECIFIC OBJECTIVE — Student are able to solve equation of mathematical modelling

B. SOFT SKILL STUDENT COMPETENCY : — Student will have good analysis and will able to explain dynamical measurement instrumentation in professional communication

C. COURSE METHOD — Teoretical Lectures, presentation and class discussion

D. MAIN COURSE DESCRIPTION — Review for midterm exam

E. SUB COURSE DESCRIPTION — Classification of transducers, methods of correction, sources of error, accuracy and precision, sensitivity, nonlinearity, propagation of error, impedance matching

F. COURSE ACTIVITY

NO	OVERVIEW	TIME ESTIMATE	CLASS ACTIVITY	STUDENT ACTIVITY	COURSE EQUIPMENT
1	INTRODUCTION	10	Presentation+discussion	Listening, reading, writing and asking	LCD Projector+Laptop
2	MAIN LECTURE	70	Presentation+discussion	Listening, reading, writing and asking	LCD Projector+Laptop
3	CONCLUSION	10	Presentation+discussion	Listening, reading, writing and asking	LCD Projector+Laptop

G. METHODS OF ASSESSMENT :

Random Quiz 10%
Homework 20 %
Midterm exam 30 %
Special Group Project 10%
Final exam 30 %

H. TEXTBOOK

1. James W. Dally et. Al, "Instrumentation for Engineering Measurement", John Wiley & Son, 2nd ed
2. Ernest O. Doebelin. "Measurement Systems Application and Design", McGraw-Hilll, 4th ed

TKM 328 : MEASUREMENT SYSTEMS (2 CREDITS)

CLASS/LABORATORY SCHEDULE	One 90-minute lectures per week
LECTURE	7

A. COURSE OBJECTIVES

1. GENERAL OBJECTIVES	Students will learn mathematical modelling of dynamical measurement instrumentation
2. SPECIFIC OBJECTIVE	Student are able to applies measurement device for kinetic and displacement

B. SOFT SKILL STUDENT COMPETENCY :	Student will have good analysis and will able to explain dynamical measurement instrumentation in professional communication
C. COURSE METHOD	Teoretical Lectures, presentation and class discussion
D. MAIN COURSE DESCRIPTION	Motion and displacement measurement
E. SUB COURSE DESCRIPTION	Classification of transducers, methods of correction, sources of error, accuracy and precision, sensitivity, nonlinearity, propagation of error, impedance matching

F. COURSE ACTIVITY

NO	OVERVIEW	TIME ESTIMATE	CLASS ACTIVITY	STUDENT ACTIVITY	COURSE EQUIPMENT
1	INTRODUCTION	10	Presentation+discussion	Listening, reading, writing and asking	LCD Projector+Laptop
2	MAIN LECTURE	70	Presentation+discussion	Listening, reading, writing and asking	LCD Projector+Laptop
3	CONCLUSION	10	Presentation+discussion	Listening, reading, writing and asking	LCD Projector+Laptop

G. METHODS OF ASSESSMENT :

Random Quiz 10%
Homework 20 %
Midterm exam 30 %
Special Group Project 10%
Final exam 30 %

H. TEXTBOOK

1. James W. Dally et. Al, "Instrumentation for Engineering Measurement", John Wiley & Son, 2nd ed
2. Ernest O. Doebelin. "Measurement Systems Application and Design", McGraw-Hilll, 4th ed

TKM 328 : MEASUREMENT SYSTEMS (2 CREDITS)

CLASS/LABORATORY SCHEDULE — One 90-minute lectures per week
LECTURE — 8

A. COURSE OBJECTIVES
1. GENERAL OBJECTIVES — Students will learn mathematical modelling of dynamical measurement instrumentation
2. SPECIFIC OBJECTIVE — Student are able to applies force, torsion, and strain measuring device

B. SOFT SKILL STUDENT COMPETENCY : — Student will have good analysis and will able to explain dynamical measurement instrumentation in professional communication

C. COURSE METHOD — Teoretical Lectures, presentation and class discussion

D. MAIN COURSE DESCRIPTION — Force, torque and strain measurement

E. SUB COURSE DESCRIPTION — Classification of transducers, methods of correction, sources of error, accuracy and precision, sensitivity, nonlinearity, propagation of error, impedance matching

F. COURSE ACTIVITY

NO	OVERVIEW	TIME ESTIMATE	CLASS ACTIVITY	STUDENT ACTIVITY	COURSE EQUIPMENT
1	INTRODUCTION	10	Presentation+discussion	Listening, reading, writing and asking	LCD Projector+Laptop
2	MAIN LECTURE	70	Presentation+discussion	Listening, reading, writing and asking	LCD Projector+Laptop
3	CONCLUSION	10	Presentation+discussion	Listening, reading, writing and asking	LCD Projector+Laptop

G. METHODS OF ASSESSMENT :

Random Quiz 10%
Homework 20 %
Midterm exam 30 %
Special Group Project 10%
Final exam 30 %

H. TEXTBOOK

1. James W. Dally et. Al, "Instrumentation for Engineering Measurement", John Wiley & Son, 2nd ed
2. Ernest O. Doebelin. "Measurement Systems Application and Design", McGraw-Hilll, 4th ed

TKM 328 : MEASUREMENT SYSTEMS (2 CREDITS)

CLASS/LABORATORY SCHEDULE — One 90-minute lectures per week
LECTURE — 9

A. COURSE OBJECTIVES
1. GENERAL OBJECTIVES — Students will learn mathematical modelling of dynamical measurement instrumentation
2. SPECIFIC OBJECTIVE — Student are able to applies force and sound measuring device

B. SOFT SKILL STUDENT COMPETENCY : — Student will have good analysis and will able to explain dynamical measurement instrumentation in professional communication

C. COURSE METHOD — Teoretical Lectures, presentation and class discussion

D. MAIN COURSE DESCRIPTION — Pressure and sound measurement

E. SUB COURSE DESCRIPTION — Classification of transducers, methods of correction, sources of error, accuracy and precision, sensitivity, nonlinearity, propagation of error, impedance matching

F. COURSE ACTIVITY

NO	OVERVIEW	TIME ESTIMATE	CLASS ACTIVITY	STUDENT ACTIVITY	COURSE EQUIPMENT
1	INTRODUCTION	10	Presentation+discussion	Listening, reading, writing and asking	LCD Projector+Laptop
2	MAIN LECTURE	70	Presentation+discussion	Listening, reading, writing and asking	LCD Projector+Laptop
3	CONCLUSION	10	Presentation+discussion	Listening, reading, writing and asking	LCD Projector+Laptop

G. METHODS OF ASSESSMENT :

Random Quiz 10%
Homework 20 %
Midterm exam 30 %
Special Group Project 10%
Final exam 30 %

H. TEXTBOOK

1. James W. Dally et. Al, "Instrumentation for Engineering Measurement", John Wiley & Son, 2nd ed
2. Ernest O. Doebelin. "Measurement Systems Application and Design", McGraw-Hilll, 4th ed

TKM 328 : MEASUREMENT SYSTEMS (2 CREDITS)

CLASS/LABORATORY SCHEDULE	One 90-minute lectures per week
LECTURE	10

A. COURSE OBJECTIVES

1. GENERAL OBJECTIVES	Students will learn mathematical modelling of dynamical measurement instrumentation
2. SPECIFIC OBJECTIVE	Student are able to applies flow measuring device
B. SOFT SKILL STUDENT COMPETENCY :	Student will have good analysis and will able to explain dynamical measurement instrumentation in professional communication
C. COURSE METHOD	Teoretical Lectures, presentation and class discussion
D. MAIN COURSE DESCRIPTION	Flow measurement
E. SUB COURSE DESCRIPTION	Classification of transducers, methods of correction, sources of error, accuracy and precision, sensitivity, nonlinearity, propagation of error, impedance matching

F. COURSE ACTIVITY

NO	OVERVIEW	TIME ESTIMATE	CLASS ACTIVITY	STUDENT ACTIVITY	COURSE EQUIPMENT
1	INTRODUCTION	10	Presentation+discussion	Listening, reading, writing and asking	LCD Projector+Laptop
2	MAIN LECTURE	70	Presentation+discussion	Listening, reading, writing and asking	LCD Projector+Laptop
3	CONCLUSION	10	Presentation+discussion	Listening, reading, writing and asking	LCD Projector+Laptop

G. METHODS OF ASSESSMENT :

Random Quiz 10%
Homework 20 %
Midterm exam 30 %
Special Group Project 10%
Final exam 30 %

H. TEXTBOOK

1. James W. Dally et. Al, "Instrumentation for Engineering Measurement", John Wiley & Son, 2nd ed
2. Ernest O. Doebelin. "Measurement Systems Application and Design", McGraw-Hilll, 4th ed

TKM 328 : MEASUREMENT SYSTEMS (2 CREDITS)

CLASS/LABORATORY SCHEDULE — One 90-minute lectures per week
LECTURE — 11

A. COURSE OBJECTIVES
1. GENERAL OBJECTIVES — Students will learn mathematical modelling of dynamical measurement instrumentation
2. SPECIFIC OBJECTIVE — Student are able to applies temperature measuring device

B. SOFT SKILL STUDENT COMPETENCY : — Student will have good analysis and will able to explain dynamical measurement instrumentation in professional communication

C. COURSE METHOD — Teoretical Lectures, presentation and class discussion

D. MAIN COURSE DESCRIPTION — Temperature measurement

E. SUB COURSE DESCRIPTION — Classification of transducers, methods of correction, sources of error, accuracy and precision, sensitivity, nonlinearity, propagation of error, impedance matching

F. COURSE ACTIVITY

NO	OVERVIEW	TIME ESTIMATE	CLASS ACTIVITY	STUDENT ACTIVITY	COURSE EQUIPMENT
1	INTRODUCTION	10	Presentation+discussion	Listening, reading, writing and asking	LCD Projector+Laptop
2	MAIN LECTURE	70	Presentation+discussion	Listening, reading, writing and asking	LCD Projector+Laptop
3	CONCLUSION	10	Presentation+discussion	Listening, reading, writing and asking	LCD Projector+Laptop

G. METHODS OF ASSESSMENT :

Random Quiz 10%
Homework 20 %
Midterm exam 30 %
Special Group Project 10%
Final exam 30 %

H. TEXTBOOK

1. James W. Dally et. Al, "Instrumentation for Engineering Measurement", John Wiley & Son, 2nd ed
2. Ernest O. Doebelin. "Measurement Systems Application and Design", McGraw-Hilll, 4th ed

TKM 328 : MEASUREMENT SYSTEMS (2 CREDITS)

CLASS/LABORATORY SCHEDULE — One 90-minute lectures per week
LECTURE — 12

A. COURSE OBJECTIVES
1. GENERAL OBJECTIVES — Students will learn mathematical modelling of dynamical measurement instrumentation
2. SPECIFIC OBJECTIVE — Student are able to select measuring device effectivelly

B. SOFT SKILL STUDENT COMPETENCY : — Student will have good analysis and will able to explain dynamical measurement instrumentation in professional communication

C. COURSE METHOD — Teoretical Lectures, presentation and class discussion

D. MAIN COURSE DESCRIPTION — Review for final exam

E. SUB COURSE DESCRIPTION — Classification of transducers, methods of correction, sources of error, accuracy and precision, sensitivity, nonlinearity, propagation of error, impedance matching

F. COURSE ACTIVITY

NO	OVERVIEW	TIME ESTIMATE	CLASS ACTIVITY	STUDENT ACTIVITY	COURSE EQUIPMENT
1	INTRODUCTION	10	Presentation+discussion	Listening, reading, writing and asking	LCD Projector+Laptop
2	MAIN LECTURE	70	Presentation+discussion	Listening, reading, writing and asking	LCD Projector+Laptop
3	CONCLUSION	10	Presentation+discussion	Listening, reading, writing and asking	LCD Projector+Laptop

G. METHODS OF ASSESSMENT :

Random Quiz 10%
Homework 20 %
Midterm exam 30 %
Special Group Project 10%
Final exam 30 %

H. TEXTBOOK

1. James W. Dally et. Al, "Instrumentation for Engineering Measurement", John Wiley & Son, 2nd ed
2. Ernest O. Doebelin. "Measurement Systems Application and Design", McGraw-Hilll, 4th ed