Fluids Engineering　　講義　2単位　2学期
Fluids Engineering

【担当教員】

TAKAHASHI Tsutomu・YAMADA Noboru

【教員室または連絡先】

BLDG No.1 of Dept Mech E, room #601 (TAKAHASHI T), room #507 (YAMADA N)

【授業目的及び達成目標】

Objectives and Goals:
Study the concept of Newtonian fluid which is the simplified model of most important fluids in engineering, i.e. air and water. Study the dynamics of Newtonian fluid based on their physics and mathematical analysis.
After this lecture, students are expected to be able to:
・ Tell the concepts of continuum, fluid and viscosity.
・ Tell the basic equation of fluid mechanics.
・ Analyze the steady laminar flow
・ Analyze the perfect fluid flow by complex function theory.
・ Calculate the flow field using approximation methods.

【授業キーワード】

Continuum, Viscosity, Equation of continuity, N-S equation, Laminar flow, Approximation method, Boundary layer theory, Perfect fluid, Vorticity, Circulation, Rate of deformation tensor

【授業内容及び授業方法】

Format: Lecture

【授業項目】

Contents

Chapter 1 Introduction
1-1 Specific aim of this lecture
1-2 Overview of science and engineering of fluid motion
1-3 What is fluid ?

Chapter 2 Derivation of Basic Equations of Fluid Motion
2-1 Acceleration of a fluid particle (Substantial derivative)
2-2 Force acting on a fluid element
2-3 Equation of motion of a continuum (Cauchy's equation)
2-4 Deformation of fluid element in flow field
2-5 Relation between stress and strain rate
2-6 Navier-Stokes equation
2-7 Law of conservation of mass applied to flow field

Chapter 3 Approach to Solutions of N-S Equation
3-1 Incompressibility and treatment of body force
3-2 Exact solutions
3-3 Approximation methods for creeping motion
3-4 Approximation for high velocity flows (Perfect fluid approximation)

Chapter 4 Theory of Perfect Fluid Flow
4-1 Bernoulli's theorem
4-2 Two-dimensional irrotational flow
4-3 Flows given by simple functions
4-4 Conformal mapping

Chapter 5 Boundary Layer Theory
5-1 Concept of boundary layer
5-2 Boundary layer approximation
5-3 Boundary layer separation

Chapter 6 Turbulent Flow
6-1 What is turbulent flow ?
6-2 Expressions for state of turbulent flow
6-3 Theory on fully developed turbulent flow

【教科書】

Sudou, Hasegawa and Shirakashi, "Mechanics of fluid (in Japanese)", Korona-sha.

【参考書】

Basic knowledge of Hydraulics and Elementary Fluid Mechanics

【成績の評価方法と評価項目】

Evaluation items are as follows;
1. The concept of fluid which is one of the models of real material is understood.
2. Basic physical low which dominates flow motion is understood.
3. The outline of fluid mechanics is understood and also the limits of the theoretical apply are understood.
4. Basic method to analyze the fluid motion can be applied for real flow.
5. Mathematical methods to achieve the engineering purpose by simplification of real flow problem are understood.

Fracture and Fatigue Strength of Materials　　講義　2単位　2学期
Fracture and Fatigue Strength of Materials

【担当教員】

MUTOH Yoshiharu・MIYASHITA Yukio

【授業内容及び授業方法】

Subject:　Fracture and Fatigue Strength of Materials
Lecturer:　Yoshiharu Mutoh
Semester: 2nd Semester
Students:　Third year Students

Keywords: Materials Strength, Structural Materials, Fracture Toughness, Fatigue

Contents:
(1) Mechanisms of fracture and fractography
(2) Linear fracture mechanics
(3) Non-linear fracture mechanics
(4) Fracture toughness and test methods
(5) Fatigue strength
(6) Fatigue crack growth
(7) Stress corrosion cracking
(8) Damage tolerent design

Basic Magnetohydrodynamics　　講義　2単位　3学期

Basic Magnetohydrodynamics

【担当教員】

HARADA Nobuhiro

【教員室または連絡先】

Room 403, 1st Building of Electrical Engineering Dept., Ext. 9511
E-mail: nob@nagaokaut.ac.jp

【授業目的及び達成目標】

Magnetohydrodynamics (MHD) is a basic subject which leads to novel electric power generation and electric propulsion system in future. This lecture introduces basic physical phenomena of plasma and interaction between electro-magnetic field and fluid dynamics. Further, applications of MHD power generation and MHD propulsion are discussed.

Main objectives are to understand
1) ionization and basic properties of plasma,
2) interaction between electro-magnetic field and fluid dynamics,
3) MHD electric power generation,
4) MHD electric propulsion, and
5) recent trend and new technologies related to MHD.

【授業キーワード】

magnetohydrodynamics, fluid dynamics, electro-magnetics, electric induction, Lorentz force, MHD power generation, MHD propulsion

【授業内容及び授業方法】

For basic plasma properties, ionization processes, charge neutrality, collision theory, and electrical conductivity are studied. We understand the plasma as electrically conductive fluid. Then in order to apply this plasma to novel power generation and propulsion system, basic governing equations for magnetohydrodynamics are explained. New topics of MHD power generation and MHD propulsion are presented.

【授業項目】

1) basic properties of plasma
2) ionization and electrical conductivity
3) basics of fluid dynamics and electro-magnetics
4) MHD power generation and generator performance
5) MHD propulsion and space application of MHD

【教科書】

Prints or handouts are provided.

【参考書】

"Magnetohydrodynamic Energy Conversion" (McGraw Hill)

【成績の評価方法と評価項目】

Score is based on several reports. Attendance and submission of report(s) are also taken into account.

Introduction to Instrumental Analysis for Electronic Materials　講義　2単位　3学期

Introduction to Instrumental Analysis for Electronic Materials

【担当教員】

KIMURA Munehiro

【教員室または連絡先】

Room 607, 1st building of Electrical Engineering Department, Extension 9540

【授業目的及び達成目標】

The lectures will cover the introduction of analytical instrumentation for electronic materials. The objectives are to give you (1) a basic understanding of the most frequently used analytical methods (e. g. scanning probe microscopy, ellipsometry, spectroscopy), (2) an overview to help you choose an appropriate analytical technique for a specific problem.

【授業キーワード】

instrumental analysis, scanning probe microscopy, ellipsometry, spectroscopy, resonance, second harmonic generation

【授業内容及び授業方法】

First, basic condensed matter physics will be outlined. Then, an overview of the instrumental analysis for electronic materials will be lectured. Finally, each student will prepare a literature research paper (ca. 10 pages) based on a current topic in instrumental analysis in an area of their choosing. The language in class is English.

【授業項目】

Classification of analytical methods and the types of instrumental methods
Scanning probe microscopy (STM, AFM)
Ellipsometry, X-ray diffraction, Second Harmonic Generation
Spectroscopy (FT-IR)
Resonance (ESR, NMR)

【教科書】

Text will be handed in the lecture.

【参考書】

Principles of Condensed Matter Physics / P. M. Chaikin, T. C. Lubensky, Cambridge University Press (1995).

【成績の評価方法と評価項目】

Attendance in lecture and class participation is required. Because class discussions are a major part of the class, attendance is required and record will be taken.

40% Literature research
40% Oral presentation (incl. rough draft)
20% Attendance in lecture, participation in discussion

Internship I	実習　4単位　通年
Internship I	

【担当教員】

Staff

【授業目的及び達成目標】

Purpose & Goal:
(1)To obtain practical experience of engineering and practical engineering skil
(2)To learn Japanese style working and production systems
(3)To find purposes for further study
(4)To know importance of engineer's ethic and safety

【成績の評価方法と評価項目】

Evaluation:
Based on
(1)Monthly report
(2)Presentatin at the end of training
(3)Evaluation sheet from company

【留意事項】

Term of the internship I is less than three months but more than two months.

Internship II	実習　8単位　通年
Internship II	

【担当教員】

Staff

【授業目的及び達成目標】

Purpose & Goal:
(1)To obtain practical experience of engineering and practical engineering skil
(2)To learn Japanese style working and production systems
(3)To find purposes for further study
(4)To know importance of engineer's ethic and safety

【成績の評価方法と評価項目】

Evaluation:
Based on
(1)Monthly report
(2)Presentatin at the end of training
(3)Evaluation sheet from company

【留意事項】

Term of the internship II is more than three months.

Project Study I	実験　4単位　通年
Project Study I	

【担当教員】

Staff

【授業内容及び授業方法】

In this subject, students carry out research project on specific topics in the related laboratory. The students approach to their research topics by synthesizing their engineering knowledge learnt up to now to solve their problems. Their skill of experiments, analysis, synthesis and development will be enhanced through the discussion with their supervisors. Evaluation will be made based on their final report and presentation.

【留意事項】

Term of the Project Study I is less than three months but more than two months.

Project Study II	実験　8単位　通年
Project Study II	

【担当教員】

Staff

【授業内容及び授業方法】

In this subject, students carry out research project on specific topics in the related laboratory. The students approach to their research topics by synthesizing their engineering knowledge learnt up to now to solve their problems. Their skill of experiments, analysis, synthesis and development will be enhanced through the discussion with their supervisors. Evaluation will be made based on their final report and presentation.

【留意事項】

Term of the Project Study II is more than three months.