

## 97-1 大葉大學 完整版課綱

### 基本資訊

|           |                 |            |                |
|-----------|-----------------|------------|----------------|
| 課程名稱      | 連體力學            | 科目序號 / 代號  | 1125 / MUR5016 |
| 開課系所      | 機械與自動化工程學系碩士班   | 學制 / 班級    | 研究所碩士班1年1班     |
| 任課教師      | 林陽泰             | 專兼任別       | 客座             |
| 必選修 / 學分數 | 選修 / 3          | 畢業班 / 非畢業班 | 非畢業班           |
| 上課時段 / 地點 | (五)567 / H227-2 | 授課語言別      | 中文             |

### 課程簡介

#### 課程描述

連體力學旨在利用鉅觀方式將應用物理學上問題的方程式化。基本上實數系統便是一個連體，一般可用三個空間實數系統 (x,y,z) 及另一個時間實數系統t來表示。通常假設一個物體的現象學上的行為可用五個基本原則來描述：質量不滅，牛頓運動定律，熱力學兩大定律，電磁原理及對稱與座標不變性條件。

#### 課程目標

利用數學演算方法以找到制御連體行為的場方程式及跳躍條件，物體上各點的物理量均為平滑函數才能定出公式。找出連體的構造方程式（例如應力與應變關係）也是本課程的目標。

### 課程大綱

1. Introduction
2. Vectors and Tensors
3. Stress
4. Principal Stresses and Principal Axes
5. Analysis of Deformation
6. Velocity Fields and Compatibility Conditions
7. Constitutive Equations
8. Isotropy
9. Mechanical Properties of Real Fluids and Solids
10. Derivation of Field Equations
11. Field Equations and Boundary Conditions in Fluid Mechanics
12. Some Simple Problems in Elasticity

### 基本能力或先修課程

工程力學、工程數學、材料力學、流力學、熱力學

## 課程與系所基本素養及核心能力之關連

具備宏觀的國際觀能力

## 成績稽核

### 教科書(尊重智慧財產權，請用正版教科書，勿非法影印他人著作)

| 書名     | 作者 | 譯者 | 出版社 | 出版年 |
|--------|----|----|-----|-----|
| 無參考教科書 |    |    |     |     |

### 參考教材及專業期刊導讀(尊重智慧財產權，請用正版教科書，勿非法影印他人著作)

| 書名           | 作者 | 譯者 | 出版社 | 出版年 |
|--------------|----|----|-----|-----|
| 無參考教材及專業期刊導讀 |    |    |     |     |

| 上課進度 |   | 分配時數(%) |    |    |    |    |
|------|---|---------|----|----|----|----|
| 週次   | 教學內容  | 講授      | 示範 | 習作 | 實驗 | 其他 |
| 1    | Introduction, Mathematical Foundations: Vectors and Tensors, del Operator   | 100     | 0  | 0  | 0  | 0  |
| 2    | Transformation of Coordinates Definition of Tensors, Fundamental Tensor Operations  | 100     | 0  | 0  | 0  | 0  |
| 3    | Quotient Law, Decomposition theorem, Tensor fields, Integral Theorems   | 100     | 0  | 0  | 0  | 0  |
| 4    | State of Stress: Newton ' s Laws for continua, Cauchy Stress Principle, Existence of Stress Tensors, Equations of Motion          | 100     | 0  | 0  | 0  | 0  |
| 5    | Symmetry of Stress Tensor, Analysis of Symmetric Stress Tensor, Characteristic Equation of Stress Tensor                          | 100     | 0  | 0  | 0  | 0  |
| 6    | Principal Stress Theorem, State of Stress Referred to a set of Principal Axes, Mohr ' s Stress Circle, Cayley-Hamilton Theorem    | 100     | 0  | 0  | 0  | 0  |
| 7    | Kinematics of deformation: Description of Motion, Homogeneous deformation, General deformation                                    | 100     | 0  | 0  | 0  | 0  |
| 8    | Measures of Deformation, Physical Meaning of Green deformation tensor, Physical Strains.  | 100     | 0  | 0  | 0  | 0  |
| 9    | Instantaneous Motion: Rates of strain, Instantaneous rates of strains ( Eulerian description )                                    | 100     | 0  | 0  | 0  | 0  |
| 10   | Material Rate of Change, Compatibility Conditions: Sufficient ( uniqueness ) theorem. Necessity ( Existence ) theorem             | 100     | 0  | 0  | 0  | 0  |
| 11   | Balance Laws and Field Equations: the general balance laws, Reynolds Transport Theorem.   | 100     | 0  | 0  | 0  | 0  |
| 12   | Fundamental Balance Laws of Continuum Mechanics, Balance of mass: Isochoric flow, Steady flow, Irrotational flow ,Potential flow. | 100     | 0  | 0  | 0  | 0  |

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|----|--|-----|---|---|---|---|
| 13 | Balance of Momenta-Equation of motion, Balance of charge, Balance of Thermo-mechanical Energy, Summary of Field Equations for thermo-mechanical Systems                | 100 | 0 | 0 | 0 | 0 |
| 14 | Constitutive Equations: Mechanically simple material, The fluid media, Stokesian Fluid, Newtonian Fluids, Isotropic tensor of rank 4, dilatational and shear viscosity | 100 | 0 | 0 | 0 | 0 |
| 15 | The Stokes ' conditions for compressible fluid, Basic equations for Newtonian Fluids, Navier-Stokes-Duhem equations of motion  | 100 | 0 | 0 | 0 | 0 |
| 16 | The Solid Media: The Linear Elastic Solid , Orthotropic , Transversely Isotropic, Thermo Elastic Solid   | 100 | 0 | 0 | 0 | 0 |
| 17 | Plastic media, Models of Linear Plastic Behavior, three dimensional theories of plastics   | 100 | 0 | 0 | 0 | 0 |
| 18 | Viscoelastic media, Boltzmann representation, Maxwell model, Kelvin model, Four parameter models ( for coal, asphalt, glass ) and applications                         | 100 | 0 | 0 | 0 | 0 |