Seoul National University of
Science & Technology
232 Gongneung-ro,Nowon-gu,
Seoul 01811 Korea

# MSDE Module Descriptor

| **Module Title**<br>Computer Aided Engineering | **Module Code**<br>MSDE 327 | **Semester (Sem 1 / Sem 2)**<br>Sem 2 |
|---|---|---|
| **Credits**<br>10 | **Level**<br>5 | **Professor and email**<br>Nak-Kyun Cho<br>nkcho@seoultech.ac.kr |
| **Delivery Method**<br>Lecture | **Delivery Location**<br>SeoulTech,<br>Mugung Hall | |

## Module Synopsis

The module concentrates on the basic theory of the Finite Element Method (FEM) and its applications by using the CAE commercial program such as the ANSYS. Before making and analysing a modelling using the ANSYS, solid mechanics are reviewed to make the students understand the theoretical backgrounds. The basic concept is introduced at the beginning while considering one dimensional problems and its extension to two and three dimensional problems is briefly discussed. Applications to one and two dimensional problems are discussed.

*Prerequisite: Mechanics of Material (or Solid Mechanics), Energy Study (or Thermodynamics), Computer Aided Design (CAD), Engineering Math, Material Technology, Fluid Mechanics, Design of Machine Elements, Computer Aided Manufacturing (CAM).*

## Outline Syllabus

**Theoretical Study**

**FEM General Overview**
Basic Concept of the FEM

**Linear Algebra**
Matrix production, addition and subtraction; Inverse matrix; Determination,

**One-dimensional Elements (Bar and Beam Elements)**
Linear one-dimensional elements; Element shape function; Stiffness matrix; Bar elements in 2D and 3-D space; Direct method and formal approach to build-up stiffness marix
Simulation : Beams and Plates
Simulation : Heat Transfer, Thermal Stresses

**Shape function**
Finite element basis functions in 1D; Element shape functions; Two-node linear element; Three-node element: quadratic interpolation; Four-node (cubic) elements; Master elements in natural coordinate; Global and element shape functions

**Two Dimensional Elements**
Statics; Finite Elements for 2-D Problems***; Stiffness matrix***

**Laboratory**
Basic Concepts for FE Programs  ANSYS;
User environment of ANSYS, and how to use it basically

How to make a modelling for FE analysis I, II, and III; Creation of FE model
Constraint and boundary conditions, application of load, and executing analysis
Examples – Truss & Beam analysis;
Practices of ANSYS using WORKBENCH II for the term project

**Indicative Reading**

1) Finite Element Analysis: Theory and Application with ANSYS (3rd Ed.), Saeed Moaveni, 2007Reference: Finite Element Simulations with ANSYS Workbench 14, Huei-Huang Lee, SDC
2) Introduction to Finite Element Analysis and Linear Analysis by TAESUNG Software & Engineering, Inc. 2010

| **NOTIONAL STUDENT WORKLOAD** | **Hours** |
|---|---|
| MODE OF DELIVERY (FT / PT / DL) | FT |
| Lectures | 30 |
| Seminars | |
| Tutorials | 10 |
| Laboratories/studios/practical | 30 |
| Directed learning | 10 |
| Independent Learning | 10 |
| Work experience/fieldwork | |
| Other: eg formal presentation | 10 |
| Total Workload<br>100 hours for a 10 credit module<br>200 hours for a 20 credit module | 100 |

| Module Learning Outcomes | |
|---|---|
| KU1,3,4 | KU1. Apply advanced knowledge of the scientific and mathematical foundations of engineering to solve problems.<br>KU3. Identify and utilise advanced methodologies to create solutions to a variety of engineering problems.<br>KU4. Define and investigate complex interdisciplinary problems and constraints that occur in mechanical engineering design with the aid of specialist tools and the latest research. |
| IPSA4 | IPSA4. Illustrate solutions to basic engineering problems. |
| PVA2,4 | PVA2. Apply creativity in the development of solutions to standard engineering problems.<br>PVA4. Apply effective interpersonal and learning skills. |

| Assessments | Assessment Type | Weighting % | Mid-Term/interim/final |
|---|---|---|---|
| Coursework | | | |
| Project | Group project 1<br><br>Group project 2 (Term project) | 25<br><br>45 | |
| Quiz | | | |
| Test | | | |
| Laboratory | | | |
| Exam | 2 hrs exam | 30 | Mid-term |
| Presentation | | | |