Department of Mechanical Engineering

1. Educational Goal

The graduate program in mechanical engineering at Hannam University is aiming to educate an engineer who will play the key roles in the forefront of the mechanical engineering industries by successfully applying engineering knowledge and tools to solve technical problems and challenges, and making contributions to his/her area of expertise with professional and serving-leadership responsibility.

2. Educational Objective

① To gear up the state-of-art technology with hands-on experience in mechanical engineering practice.

② To promote the novel application of fundamental engineering science, interdisciplinary activities, and research skills.

③ To cultivate the creativity and the activeness to deal with the rapidly-changing technology with agility.

3. List of Full-time Faculty

Name	Position	Degree(University)	Field of Instruction	Area of Research
Yeong Sung Suh	Professor	Ph. D. in Rensselaer Polytechnic Institute	Mechanical Engineering	Computational Solid Mechanics, Plasticity
Woo Gun Sim	Professor	Ph. D. in McGill University	Mechanical Engineering	Fluid-Induced Vibration, Fluid Dynamics
Cheol Ho Hwang	Professor	Ph. D. in Seoul National University	Mechanical Engineering	Environmental Acoustics and Vibration Analysis, Dynamics
Moon Shik Park	Professor	Ph. D. in KAIST	Mechanical Engineering	KBE/DFMA, CAD/CAM/CAE, Engineering Design, Production Engineering
Cheon Seog Yoon	Professor	Ph. D. in University of Alabama, Huntsville	Mechanical Engineering	CFD, Combustion Engineering, Thermodynamics
Bong Soo Kang	Professor	Ph. D. in KAIST	Mechanical Engineering	Robotics and Intelligent Machine, Automatic Control
In-Ha Sung	Professor	Ph. D. in Yonsei University	Mechanical Engineering	Micro/Nano Mechanics and Manufacturing, Tribology, Surface Engineering,

				Ultla-precision Manufacturing, CMP in Semiconductor, Nano-measurement
Yong-Taek Lee	Associate Professor	Ph. D in Korea University	Mechanical Engineering	Heat Transfer, Thermal Engineering, Renewable Energy
Ki Nam Jung	Assistant professor	Ph. D. in Seoul National University	Mechanical Engineering	Mechanical design, nanofabrication, plasmonics, photonics, optical simulation

4. Course Description

MECHANICAL ENGINEERING

- **ME601 연속체역학 (Continuum Mechanics) 3 credits**

  This course is an introduction to continuum theory on basis of solid, thermal, and fluid mechanics. Essential mathematics, stress principles, kinematics of deformation and motion, fundamental laws and equations, linear elasticity, classical field, nonlinear elasticity, and linear viscoelasticity are discussed.

- **ME602 응용수학 I (Applied Mathematics I) 3 credits**

  This is the part 1 of the mathematics course for the advanced level of mechanical engineering analysis, which includes linear algebra, calculation of variations and applications, and integral equations.

- **ME603 응용수학 II (Applied Mathematics II) 3 credits**

  This is the part 2 of the mathematics course for the advanced level of mechanical engineering analysis, which includes separation of variables method, Fourier series, Strum-Liouville eigenvalue problems, partial differential equations with at least three independent variables, Green's function, infinite domain problems – Fourier transform solutions of partial differential equations, linear and quasi-linear wave equations, Laplace transform, finite difference numerical methods, and complex variables.

- **ME604 응용수치해석 (Applied Numerical Analysis) 3 credits**

  This course includes practices of applied numerical analysis using commercial and/or in-house software. Roots of equations, linear algebraic equations and matrices, Gauss elimination, LU decomposition, matrix inverse and condition, iterative methods for systems of equations, curve fitting, general linear least-squares and nonlinear regression, numerical integration, ordinary

differential equations, and Eigenvalues included.

• **ME605 소성역학 (Engineering Plasticity) 3 credits**
This course is an introduction to the theory of plasticity and its application to engineering. Topics include macroscopic plasticity and yield criteria, work hardening, plastic instability, strain rate and temperature, ideal work, upper bound analysis, slip-line theory, formability, plastic anisotropy, and sheet-metal forming.

• **ME606 유한요소해석 (Finite Element Analysis) 3 credits**
The objective of the course is to introduce finite element methods for approximate numerical solutions to engineering problems. The course concentrates on solution of structural problems, but also provides the basis for expanding that focus to other engineering field problems (e.g., thermal, electromagnetic). The course includes: introduction to the fundamentals of structural finite element modeling. geometry creation, use of element types, material specification, problem solution and results postprocessing. A focus is placed on modeling techniques and guidelines using commercially available software.

• **ME607 최적설계론 (Theory of Optimum Design) 3 credits**
In this course, students learn to transform mechanical design problem into mathematical programming based upon linear algebra and numerical techniques. Linear and nonlinear programming methods are used to solve a design problem. Optimality criteria method and Lagrange method as well as linear, quadratic, or convex approximation techniques are taught to analyze complex mechanical design problems, emphasizing the application in the mechanical design practices.

• **ME608 컴퓨터응용설계 (Computer Aided Design) 3 credits**
This course discusses computer definition of products with geometric modeling via computational geometry of curves and surfaces, solid, and topology modeling and also practices on related computer graphics and their programming. Students learn product data other than geometric data as a means of product management such as STEP, PDM, etc

• **ME609 Tribology특론 (Tribology) 3 credits**
Tribology is the study on friction, wear, lubrication and surface engineering directly related to the reliability of machine elements and mechanical systems. Tribology is one of the infra-technologies and core-technologies applied to main industries from automotive engineering, space engineering, heavy industry to nanotechnology such as MEMS, advanced materials engineering, medical and

biological engineering, and information storage. This course covers various topics related to friction, wear and lubrication. In addition, students can learn & show how friction tests are carried out and the results are analyzed through laboratory sessions.

- **ME610 마이크로.나노제조공학 (Micro Nano-Fabrication) 3 credits**

  This course introduces theories and technologies of micro/nano-fabrication. Lectures focus on basic processing techniques such as photolithography, nano-imprinting, SPM(Scanning Probe Microscopy)-based nanolithography, and more about ultra-thin film deposition. Students are expected to gain an understanding of these processing techniques, and how they are applied in device fabrication.

- **ME611 전산유체역학 (Computational Fluid Mechanics) 3 credits**

  The purpose of this course is to familiarize students with numerical methods of treating differential equations in fluid and thermal engineering fields. In this course, participants develop abilities for predicting and analyzing diverse physical phenomena by using a program. Through homework assignments on the various contents as well as term projects, students can analyze physical models numerically. The purpose of this course is to study logical methods to develop computational turbulence models at various closure levels. Modeling philosophy is exemplified in detail for the mixing length model and the two-equation model. The model behavior is investigated with a number of ideal benchmark flows and the effects of model constants. Recent methods of LES and DNS are also presented.

- **ME612 기체역학 (Gas Dynamics) 3 credits**

  Problems of the flow of a compressible fluid have been studied for a long time. Ever since then, many features of shock wave, nozzle flow, supersonic jet, and thin supersonic wing showed that these phenomena were closely related to this subject. Initially, it was restricted to the ballistics and steam turbine, but it was extended for the development of fast aircraft, of missiles, of explosives with large energy release. The choice of a specific configuration, such as an optimum wing, a wind tunnel, or a shock tube, is governed by a large number of stringent constraints. It provides the concept of compressible flow theory.

- **ME613 고급열역학 (Advanced Thermodynamics) 3 credits**

  In this subject, the theoretical basis of classical thermodynamics is developed and fundamental equation in the energy representation is introduced. Phase equilibrium and chemical equilibrium are treated progressively as complex applications. Also, this course deals with the thermodynamics of systems in

electric, magnetic, stress, other potential fields, and thermodynamics of surfaces and nucleation.

• **ME614 유압공학 (Oil Hydraulic Power and Control) 3 credits**

The objective of this course is to study the basic principles in analysing the performance of axial, centrifugal, regenerative type and optimum design of turbomachines. In order to establish sound theoretical background, fluid mechanics and thermodynamics are re-examined in depth. The analysis and design methods presented in this course can be directly applied to practical industrial fields. An introduction to tribology, such as the science and technology of interacting surfaces in relative motion, related subjects, and practices, are also provided. Additional topics include the physics and basic mechanism of friction, wear and lubrication and its application to machine systems.

• **ME615 구조동역학 (Structural Dynamics) 3 credits**

This course will cover the following topics:Hamilton's principle and Lagrange's equations, free and forced vibrations of lumped-parameter and continuous systems, and a review of MDOF vibration problems, using matrix formulation and normal mode superposition methods, In addition, time and frequency domain solution techniques including convolution and Fourier transforms, applications to vibration isolation, damping treatment, and dynamic absorbers are also included.

• **ME616 진동학특론 (Special Topics in Vibrations) 3 credits**

This course will introduce the physical concepts of mechanical vibration in machinery. The topics covered will include: advanced analytical theory and techniques for identification of vibration, methods for analyzing the vibration of continuous systems, several examples and applications of vibration analysis, including vibration isolation and dynamic absorbers, and rotating machinery.

• **ME617 소음및진동제어 (Noise and Vibration Control) 3 credits**

This course will introduce the basic principles of noise control. The topics covered will include: sound sources and sound fields, room acoustics, sound transmission, noise control materials, mufflers and silencers, active noise control, principles of noise control, principles and design of vibration absorbers, and characteristics of damping material.

• **ME618 선형시스템제어 (Linear System Control) 3 credits**

The object of this course is to improve the capability of graduate students to analyse a given linear control system. This course covers the modelling of mechanical and electrical systems, state space equations, stability, controllability and observability, pole-placement, LQ controller, and observer design, etc.

• **ME619 메카트로닉스응용 (Application of Mechatronics) 3 credits**

This course is designed to give graduate students the ability to understand basic principles of microprocessors and their applications to intelligent machine design. Contents of this course include analog to digital converters, signal processing, microcontroller programming, data acquisition, sensors and actuators.

• **ME620 비선형전산고체역학 (Computational Nonlinear Solid Mechanics) 3 credits**

This course covers the formulations and solution strategies for finite element analysis of nonlinear problems. Solution techniques for solving nonlinear equations, constitutive equations and boundary conditions in solid mechanics and heat transfer, variational principles and weak formulations, incremental finite-element formulation, numerical implementations of the constitutive equations, contact problems and solving nonlinear problems using ABAQUS or ANSYS are discussed.

• **ME621 난류유동 (Turbulence) 3 credits**

Fundamental knowledge on fluid flows is discussed. Derivation of the basic equations and several relevant approximate flow models are introduced. Both inviscid and viscous fluid models are treated. An introduction to turbulence and the topics of governing equation and turbulent flows, statistical description of turbulence, kinematics and dynamics of homogeneous turbulence, spectral dynamics of turbulence, boundary-free shear flows, wall-bounded shear flows, and recent trends in turbulence research are covered.

• **ME622 경계층이론 (Boundary Layer Theory) 3 credits**

This course discusses equations of viscous flow of classical, analytical, and numerical solutions, flow regimes and approximations, laminar boundary layers, solution methods, and applications, introduction to stability theory, turbulent boundary layers, mean-flow and Reynolds stress equations, modeling, solution procedures, and applications.

• **ME623 연소공학 (Combustion Engineering) 3 credits**

Today's combustion engineers and scientists are often confronted with complex phenomena which depend upon interrelated processes of fluid mechanics, heat and mass transfer, chemical kinetics, thermodynamics, and turbulence. An understanding of fundamental concepts of these coupled processes will provide engineers and scientists with the technical background and training required to solve various combustion problems. This class is devoted to the fundamentals of chemically reacting flow systems with application to power production, jet and rocket propulsion, fire prevention and safety, pollution control, and material processing industries, etc.

• **ME624 경계요소법 (Boundary Element Method) 3 credits**

The Boundary Element Method is a recently developed numerical technique and has emerged as a powerful alternative to the FEM, particularly in cases where the domain extends to infinity. The most important feature of the BEM is that it only requires discretization of the surface rather than the volume. Acoustics is an ideal application area for the BEM because of the ease with which it can address the difficulties encountered when dealing with infinite domains which are so often an important part of acoustics problems. This course provides the basic formulations and fundamental concepts, and applications in BEM in acoustics.

• **ME625 최적제어 (Optimal Control) 3 credits**

The course is designed to give graduate students the introduction of linear quadratic design concepts and performance comparison between optimal control theorems and conventional classic control theorems. This course deals with H-infinity control scheme, robustness to noise and model uncertainty, and optimal estimation problems.

• **ME626 신뢰성공학 (Reliability Engineering) 3 credits**

Reliability engineering deals with the estimation, prevention and management of high levels of "lifetime" engineering uncertainty and risks of failure. The scope of this course includes: (1) root cause analysis of critical failures, (2) reliability models of components and systems, (3) development of statistical methods for estimating the reliability of a product, and (4) methodologies to influence system designs. After successful completion of the course, the students will be able to analyze data related to reliability questions and use the analytical results to predict the reliability of simple and complex systems.

• **ME701 기계재료거동 (Mechanical Behavior of Materials) 3 credits**

This course deals with mechanical behavior of materials and its influence on design applications. Topics include failure of structural materials, fracture, fatigue, creep, and damping.

• **ME702 공기역학 (Aerodynamics) 3 credits**

Aerodynamics and Fluid Dynamics is a wide study of elemental flow and applied flow phenomena related to movement of Aero and fluid dynamics. It is a study of general heat flow and noise phenomena through theory, experiments, and numerical analyses using computers. Related fields are phenomena related to the flow of vehicles, compressor and turbine flow of engines, turbo pumps, regenerator cooling of rocket engines, and helicopter rotors. Students also conduct experiments on subsonic and supersonic flow by scientific method and sensors.

• **ME703 대류열전달 (Convection Heat Transfer) 3 credits**

This course deals with forced and natural convection heat transfer. Mass, energy, and momentum conservation are considered for laminar and turbulent flow to analyze the heat and mass transfer. Derivation and normalization of boundary layer equation are treated. Analytical and experimental approaches are suggested to solve the heat and mass transfer problems for external and internal forced flow.

• **ME704 수송체현상 (Transport Phenomena) 3 credits**

This course presents the subjects of momentum transport viscous flow, energy transport heat conduction, convection, and radiation, and mass transport diffusion. Topics include the derivation and solution of the differential equations, which describes the transport phenomena. This course develops the ability to formulate and solve mathematical models for physical situations.

• **ME705 재생에너지 (Renewable Energy) 3 credits**

The field of energy conversion is so broad and covers so many disciplines. Moreover, so much research is being carried out in this area that the field is constantly changing. This course presents the basic theory associated with almost all of the proposed energy-conversion systems. It covers conventional and renewable energies such as solar, wind, geothermal, ocean, biomass, and fuel cell.

• **ME706 모우드해석 (Modal Analysis) 3 credits**

This course introduces the fundamental ideas of random vibrations, digital spectral analysis, which involves the measurement and analysis of random vibrations, and modal analysis of continuous systems, which is the process of constructing a mathematical model to describe the vibration properties of a structure based on test data rather than a conventional theoretical analysis.

• **ME707 랜덤신호의주파수분석 (Frequency Analysis of Random Signal) 3 credits**

This course will provide a solid theoretical foundation for analysing and processing experimental data. The topics covered will be as follows: Introduction to real-time Computation, Fourier methods, convolution, frequency/time domain processing, discrete-time signal processing, sampling theorem, aliasing, quantization, sampled data systems, the DFT and its relationship to the continuous FT, the FFT and implementations, random processes, power spectral density(PSD) estimation and applications.

• **ME708 음향학특론 (Special Topics in Acoustics) 3 credits**

This course will cover the following topics: fundamental concepts of sound

generation, transmission, absorption and radiation phenomena, the linear acoustic wave equation, sources of sound, reflection, refraction, transmission and absorption. Application of the fundamental concepts in engineering acoustics will be made with respect to sound transmission through barriers, intensity measurements, sound absorption, and propagation.

- **ME709 소음측정및분석 (Measurements and Analysis of Acoustic Noise) 3 credits**
  The objective of the course is to provide theoretical background of acoustical measurement methods and analysis of data. This course will cover the following topics: data acquisition system, analysis methods of acquired data, several measurement systems, and software techniques.

- **ME710 이산시스템제어 (Discrete Time Control) 3 credits**
  This course is designed to introduce the basic concept of discrete time control in the time domain and the state space. Topics of this course include the z tranform, the discretization of continuous system, a sampling theory, discrete state space equations, Lyapnov stability, pole-placement methods, and a discrete Kalman filter.

- **ME711 측정학 (Metrology) 3 credits**
  This course is designed to introduce the subject of precision dimensional metrology applicable to various engineering fields, especially micro/nano manufacturing industry. This course deals with active and passive transducers, mathematical model of measuring instruments, amplifiers, filters, data transmission.

- **ME712 파괴역학 (Fracture Mechanics) 3 credits**
  This is an introductory course of fracture mechanics and its applications. Topics include linear elastic fracture mechanics, elastic-plastic fracture mechanics, dynamic failure, and fracture behavior.

- **ME713 전산기구설계및해석 (Computational Mechanism Design and Analysis) 3 credits**
  This course discusses methods relating analyses and syntheses of mechanism and its kinematics using computational methods by digital computer. Practices to use mathematical softwares or direct coding techniques especially for three dimensional mechanism are also discussed.

- **ME714 표면공학특론 (Surface Engineering) 3 credits**
  Surface engineering is the sub-discipline of materials science which deals with the surface of solid matter. Physics and theories about surface energy, surface

tension, surface forces, energy band, and interface phenomena are discussed. The course also discusses micro/nano-metrology, surface-sensitive characterization techniques such as AFM(Atomic Force Microscopy), SEM(Scanning Electron Microscopy), XPS(X-ray Photoelectron Spectroscopy), and AES(Auger Electron Spectroscopy).

- **ME715 나노.원자스케일역학 (Nano-Atomic-Scale Mechanics) 3 credits**
  This course is designed to introduce graduate students to the micro- to atomic-scale mechanics and the corresponding overall mechanical properties of heterogeneous materials, including elastic, viscoelastic, and elastoplastic behavior of materials. Nano/atomic-scale mechanics can be provided as a new tool to be used in design, processing, testing, and control of structural and mechanical components in engineering. The course covers the topics of contact mechanics, solid-solid and interactions, self-assembly mechanisms, quantum mechanics, molecular dynamics, and nanoscale physics.

- **ME716 나노재료역학 (Mechanics of Nanomaterials) 3 credits**
  The course is to provide the student with the connections needed to understand the intense activity in the area of the mechanics of nanomaterials, and to develop ways of thinking about these new materials that could be useful to both research and application. The course includes fundamentals of mechanics of materials, nanoscale mechanics and materials, experimental techniques, mechanical properties: density and elasticity, plastic deformation of nanomaterials, mechanical failure processes in nanomaterials, scale-dominant mechanisms in nanomaterials, modeling nanomaterials.

- **ME717 공학설계특론 (Special Topics in Engineering Design) 3 credits**
  This course introduces design methodologies for mechanical systems. Topics include mathematical approaches such as multi-disciplinary optimization, Taguchi method, response surface method, genetic algorithm, robust design, Pareto optimality and conceptual or practical approaches such as design for manufacture, and knowledge based engineering, etc.

- **ME718 초미세기전시스템 (MEMS & NEMS) 3 credits**
  This course covers design, analysis, control and fabrication of MEMS/NEMS (Micro/Nano-Electro-Mechanical systems). Several applications of MEMS and NEMS are also explored. The main focus is to understand the fundamental challenges and limitations involved in developing and testing MEMS devices and systems. This course will also explore the world of quantum controlled nano-electro-mechanical systems (NEMS). Topics that will be covered are scaling laws and principles for NEMS, modeling of NEMS devices and structures, control of NEMS, and applications of NEMS in carbon nanotubes, nanowires, etc.

• **ME719 나노.바이오.정보융합기술 (Nano-Bio-Information-Technology) 3 credits**
A new discipline is emerging at the intersection of biotechnology, information technology, and nanotechnology. Students will explore a range of applications involving emerging and converging technologies in the nano-bio-information. Topics include nano-bio sensors, proteomics, RNA-scaffolded nanostructures, single molecule transistor, DNA computing, carbon nanotubes, bio-informatics, and smart drug delivery, etc.

• **ME720 기계정보프로그래밍(Mechanical Engineering Programming) 3 credits**
In this course, students investigate types of information, handling of information and their implementation regarding design and manufacturing organizations in enterprise environment. Database and handling systems related to manufacturing functions such as drawing, bill of material, procurement and purchase, raw material management, tool management, process and labor planning are also covered, as well as practices on recording and query of database and its application using script languages for the web.

• **ME721 추진공학 (Propulsion) 3 credits**
This subject presents the thermodynamic and aerodynamic theory forming the basic of gas turbine design. Also, it treats basic technology, performance, and design rationale of rocket propulsion that uses energy derived from chemical combustion.

• **ME722 열유체특론 (Special Topics in Thermo Fluids) 3 credits**
This course treats up-to-date thermo-fluid technology with academic and industrial aspect of view. It is combined with a series of lectures and seminars related to thermodynamics, fluid mechanics, heat transfer, and combustion area.

• **ME723 비정상유동 (Unsteady Flow) 3 credits**
When the rigid structure executes translational oscillation, fluid inertia and damping forces on the oscillating cylinder are generated by unsteady pressure and viscous skin friction. Considering the dynamic-characteristics of unsteady viscous flow and the added mass coefficient of inviscid fluid, these hydrodynamic forces including viscous effect are dramatically simplified and expressed in terms of oscillatory Reynolds number and the geometry of annular configuration. The viscous effect on the forces will be introduced with an existing theory.

• **ME724 공장소음제어 (Industrial Noise Control) 3 credits**
This course deals with machinery noise and the method to control it. The objectives of this course are to provide the principles of machinery acoustics, the sources of noise in machinery, and the means available to reduce it. The

topics on enclosures, noise barriers, mufflers, and silencers will be covered.

• **ME725 공정제어 (Process Control) 3 credits**
This course is designed to give graduate students knowledge of manufacturing system and automation in terms of sequence control, PLC programming, system optimization, and robotics. The most updated topics related to process control schemes and flexible manufacturing systems are also discussed.

• **ME726 유공압제어 (Hydraulic and Pneumatic Control) 3 credits**
The course is designed to give graduate students an understanding of hydraulic /pneumatic systems, and their nonlinear behaviors. This course deals with the fundamental principles of basic components such as a pump, a valve, a cylinder, and the control schemes for a nonlinear system.

• **ME727 차량소음특론 (Special Topics in Transportation Noise) 3 credits**
This course will cover the following topics:characteristics and mechanism of transportation noise, noise index for rating the vehicle noise, noise impact on human being, and noise reducing methods.

• **ME728 로보틱스특론 (Advanced Topics in Robotics) 3 credits**
The object of this course is to give graduate students an understanding of robot systems and interesting topics related to intelligent robots that have been developed recently. This course deals with kinematic and dynamic analysis of a manipulator, localization of a mobile robot, control architecture of a biped robot, and artificial intelligence for a robotic system.

• 석사논문연구Ⅰ (Research for the Master's Degree Ⅰ) 0 credits
• 석사논문연구Ⅱ (Research for the Master's Degree Ⅱ) 0 credits
• 박사논문연구Ⅰ (Research for the Doctoral Degree Ⅰ) 0 credits
• 박사논문연구Ⅱ (Research for the Doctoral Degree Ⅱ) 0 credits
• 박사논문연구Ⅲ (Research for the Doctoral DegreeⅢ) 0 credits