

Department of Mechanical Engineering and Industrial Engineering

Contact Information

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Industrial Engineering Program Educational Objectives

The Educational Objectives of Industrial Engineering Undergraduate Program are to prepare its graduates who, after the first few years of their professional career, will have:

- Established themselves as practicing industrial engineers or are advancing their studies through graduate school, and
- Successful careers in engineering and beyond and will have assumed professional roles of increasing responsibility and impact, and
- Established themselves as critical, creative thinkers and leaders in their profession and in society, and
- Continued to develop skills and acquire new knowledge in engineering, business, management, or other Industrial Engineering related fields.

Mechanical Engineering Program Educational Objectives

The Educational Objectives of Mechanical Engineering Program are to prepare graduates who, after the first few years of their professional career, have:

- Established themselves as practicing mechanical engineers or are advancing their studies through graduate school, and
- Adapted to ever-changing demands by updating their core knowledge and abilities, and
- Functioned successfully in their professional responsibilities, which may include economic, environmental, safety, health, and ethical aspects, and
- Established themselves as critical, flexible thinkers and leaders in their profession and in society.

General Engineering (GEEN)

GEEN 1201 Engineering as a Career **2 SCH (1-3)**

Overview of the history of engineering, its disciplines and professional practice with emphasis on social responsibility and ethical behavior. Introduces each engineering discipline using three-week modules. It also provides basic skills, tools and techniques applied to problem solving, teamwork and communication necessary for academic and professional success.

GEEN 4301 Multi-Disc Engr Design I **1-3 SCH (1-3)**

Phase one of major project of an original nature carried to completion over a period of two semesters. Completed course sequence may be substituted for senior design sequence (architectural, civil, environmental, and mechanical engineering and computer science) or final senior design course (chemical, electrical, and natural gas engineering) as appropriate to student's major. Prerequisites: Permission of student's department chair and senior standing in engineering.

GEEN 4302 Multi-Disc Engr Design II (WI) **2-3 SCH (2-3)**

Phase two of a major project of an original nature carried to completion over a period of two semesters. Completed course sequence may be substituted for senior design sequence (architectural, civil, environmental, and mechanical engineering and computer science) or final senior design course (chemical, electrical, and natural gas engineering) as appropriate to student's major. Prerequisite: GEEN 4301.

Industrial Engineering (IEEN)

IEEN 2310 Appl. Meth. in Engr. Stat. I **3 SCH (3-0)**

An introduction to basic concepts, methods, techniques and major statistical software packages in applied statistics and data analysis. Topics include descriptive and basic inferential statistics: sampling, probability distributions, estimation, hypothesis testing, and analysis of variance. Prerequisite: MATH 2413.

IEEN 3310 Appl. Meth. in Engr. Stat. II **3 SCH (3-0)**

Basic experimental designs, tests of hypothesis, analysis of variance, correlation and regression, and factorial design. Prerequisite: IEEN 2310 and MATH 2414.

IEEN 3314 Engr. Meth. In Qual Assurance **3 SCH (2-3)**

Quality control with statistical principles applied to problems in various production systems, control chart concepts, process capability analysis and sampling inspection plans; laboratory exercise for exposure to basic metrology and applied statistics for quality control applications in discrete-item manufacturing systems. Prerequisite: IEEN 2310.

IEEN 3315 Comp. Based Prod. & Inv. Con. **3 SCH (3-0)**

Modeling, design, and optimization of systems for production and inventory control, forecasting and market analysis, time series analysis, fixed order size systems, batch type production systems, discrete demand systems, MRP and JIT. Prerequisite: MATH 3320.

IEEN 3321 Op. Research Meth. in Engr. I **3 SCH (3)**

Development and application of fundamental deterministic analytical methods including linear programming, integer programming, transportation problems, assignment problems. Prerequisite: MATH 2414.

IEEN 3325 Engr Economic Analysis I **3 SCH (3-0)**

Basic concepts of time value of money and economic equivalence, correlation between engineering design and the economic issues, fundamental engineering project incorporates simple and compound interest, present and future worth, equal payment series, depreciation, rate of return calculation, replacement analysis, capital budget, and cost comparisons. Prerequisite: junior standing.

IEEN 3341 Human Factors and Ergonomics **3 SCH (3-0)**

Human capacity and limitation within a system that covers human information processing, biomechanical functioning, and workstation and job design. Human factor and ergonomic principles in engineering design and analysis. Prerequisite: Junior Standing.

IEEN 4163 Senior Design Project I **1 SCH (1-0)**

Capstone design course emphasizing quantitative analysis including statistical methods, operations research, and simulation as applied to the design process. Prerequisite: IEEN 3310 and senior standing in Industrial Engineering.

IEEN 4264 Senior Design Project II (WI) **2 SCH (1-3)**

Capstone design emphasizing analysis and design of manufacturing systems, cellular design, flexible manufacturing systems, and manufacturing integration. Integrates knowledge gained from all required industrial engineering courses in a system design project. Prerequisite: IEEN 4163 and senior standing in Industrial Engineering.

IEEN 4312 Supply Chain Management **3 SCH (3-0)**

This course applies operations research techniques to optimize the design, planning and operation of supply chain systems. Facility location, capacity allocation, transportation, inventory, and risk management. Prerequisite: IEEN 3321 or approval of instructor.

IEEN 4313 Standards in Supply Chain **3 SCH (3-0)**

An introduction to basic concepts and knowledge of standards of cybersecurity in supply chain and their applications. An introduction to assessment and mitigation of cybersecurity risks in supply chain. Prerequisite: senior standing.

IEEN 4316 Facility Design & Plant Layout **3 SCH (2-3)**

Modern plant layout and materials handling practices, stressing the importance of interrelationships with management planning, product and process engineering, and production control. Prerequisite: IEEN 2310 and senior standing.

IEEN 4321 Op. Research Meth. in Engr. II **3 SCH (3)**

Development and application of probabilistic analytical methods including decision making, Markov chains, queuing systems and Game theory. Prerequisite: MATH 3415.

IEEN 4325 Engr. Economic Analysis II **3 SCH (3-0)**

Advanced topics in economics analysis and control of industrial enterprises. Cash flow estimating, measuring costs in industry, economic budgeting, planning, decision making, taxes, and financial analysis for engineering design and manufacturing of products/systems. Prerequisite: IEEN 3325.

IEEN 4328 Appl. of Computer Simulation **3 SCH (2-3)**

Basic simulation modeling, advanced simulation including discrete events, queuing systems, inventory systems, and manufacturing systems, and analysis of computer simulation models using simulation language. Prerequisite: IEEN 3310.

IEEN 4332 Prin of Engr Proj Management **3 SCH (3-0)**

Techniques relating to managing engineering activities, engineer's transition into management, financial decision making, engineering managerial functions, motivation of individual and group behavior, productivity assessment/improvement, management of the quality function and communications. Prerequisite: senior standing or approval of instructor.

IEEN 4334 Lean Manufacturing **3 SCH (3-0)**

Lean terminology and philosophy, Just-in-Time, six sigma, and continuous improvement. Lean manufacturing approaches to help increase the efficiency of materials handling and flow, reduce manufacturing costs, reduce or eliminate waste, and increase profit margins. Prerequisites: MATH 2413, senior standing or approval of instructor.

IEEN 4335 Special Problems **1-3 SCH (0-0-1-3)**

Individual solution of selected problems in Industrial Engineering conducted under the direct supervision of a faculty member. May be repeated up to 6 hours. Prerequisite: Senior Standing.

IEEN 4336 Selected Topics **1-3 SCH (0-0-1-3)**

Advanced topics in Industrial Engineering related to new technology or cutting-edge research. May be repeated when topic changes. Prerequisite: Senior Standing.

IEEN 4351 Reliability & Adv. Top. in QC 3 SCH (3-0)

Reliability measures, reliability and hazard functions, failure density functions and system failure models, important distribution function models, reliability estimations, sequential life testing, total quality control including business quality management, and application of total QC in the company. Prerequisite: IEEN 3314.

IEEN 4354 System Safety Engineering 3 SCH (3-0)

System safety analytical techniques, product safety program, risk assessment, human factors, automations, working environments and product liability applications relative to the design of systems for government, military and general industry. Prerequisite: senior standing or approval of instructor.

IEEN 4360 Comp. Int. Manuf. Sys. 3 SCH (3-0)

System concept of computer integrated manufacturing system, definition of manufacturing and its various levels, planning and control of product movement through the production system, successful use of automation, robotics, just-in-time manufacturing, and knowledge-based systems. Prerequisite: IEEN 3315.

Mechanical Engineering (MEEN)

In addition to the listed prerequisites for the following 4000 series courses, a student must have an overall grade point average of 2 or higher.

MEEN 1201 Intro to Mech Eng as a Career 2 SCH (1-3)

The art and practice of mechanical engineering and its role in society. Promotes critical and analytical thinking; gives basic skills for the engineering approach to problem-solving, engineering design process and reverse engineering; and introduces engineering ethics. Fee: \$5.00

MEEN 1310 Engineering Graphics I 3 SCH (2-3)

Introduction to computer-aided engineering design and analysis; principles of graphics, solid modeling, integrated applications of software in engineering drafting, design and problem solving.

MEEN 1320 Elem Num Meth & Engr Prob Solv 3 SCH (2-3)

Engineering problem-solving using high level programming language and numerical computing software. Programming logic; linear algebra and matrices; solutions to systems of linear equations; interpolation and curve fitting; numerical integration and differentiation.

MEEN 2146 Engineering Measurements 1 SCH (0-3)

Basic experimental techniques and instrumentation commonly found in industry. Experimental planning and analysis. ASTM methods introduced. Data acquisition means studied. Significance of data and presentation (written and oral). Computer usage and report writing emphasized. Prerequisites: PHYS 2325/ PHYS 2125. Fee: \$5.00

MEEN 2301 Mechanics I Statics 3 SCH (3-0)

Application of Newtonian Mechanics to a broad range of Mechanical Engineering problems. Engineering units, particle and rigid body equilibrium, vector operations, torque, friction related to various mechanical elements (screws, wedges, belts, bearings), shear and moment diagrams, centroids, moments of inertia (area, mass, and products of inertia), Mohr's Circle, principle of virtual work. Prerequisite: PHYS 2125, PHYS 2325, and credit or registration in MATH 2414.

MEEN 2302 Mechanics II Dynamics 3 SCH (3-0)

Kinematics of particles and rigid bodies; motion relative to translating and rotating reference frames. Kinetics of particles and rigid bodies: Newton's second law, work-energy and impulse and momentum. Introduction to vibrations. Prerequisite: CEEN 2301 with a grade of C or higher.

MEEN 2355 Statics and Dynamics 3 SCH (3-0)

Resultants of force systems. Equilibrium of rigid bodies. Friction. Centroids and moments of inertia. Kinematics and kinetics of particles and rigid bodies. This course cannot be taken for credit by CEEN and MEEN majors. Prerequisites: PHYS 2325/2125 and MATH 2414.

MEEN 3145 Material Science Laboratory 1 SCH (0-3)

Tensile, impact, fatigue, hardness and hardenability, creep, phase and microstructure, corrosion testing and microscopic analysis. Ferrous and non-ferrous materials and polymers are studied. ASTM methods are introduced and applied. Introduction to data acquisition and recording. Reporting in both written and oral format. Prerequisite: Credit or registration in MEEN 3344. Fee \$15.00. Fee: \$15.00

MEEN 3344 Materials Science 3 SCH (3-0)

Atomic and crystal structure of materials. Chemical, mechanical, electrical and thermal properties of engineering materials. Materials selection and design. Prerequisites: CHEM 1311, CHEM 1111 and MATH 2413, and credit or enrollment in PHYS 2326 and PHYS 2126.

MEEN 3347 Thermodynamics 3 SCH (3-0)

Basic laws governing energy transmission. Thermodynamic properties of liquids and vapors, the ideal gas law and the behavior of ideal gases. Concept of reversible process. Prerequisites: MATH 2414 and PHYS 2325/ PHYS 2125.

MEEN 3348 Heat Transfer 3 SCH (3-0)

Fundamental laws relating to heat transfer including steady and transient heat conduction, forced, convection, natural convection and radiation. Introduction to heat exchanger design. Prerequisites: MEEN 3347, MEEN 3392, and MATH 3320.

MEEN 3349 Fundamentals of Mfg Processes 3 SCH (2-3)

Selection criteria for manufacturing processes, processing of castings, bulk deformation process, sheet metal working, polymer and polymer-matrix composite production, machining and welding processes. Prerequisites: MEEN 1310 and MEEN 3344.

Fee: \$10.00

MEEN 3350 Machine Design I 3 SCH (3-0)

Application of principles of mechanics and physical properties of materials to the design of machine elements such as shafts, springs, power screws and gears. Prerequisites: CEEN 3311, MEEN 2302, MEEN 3145, and MEEN 3344.

MEEN 3352 Kinematics of Machines 3 SCH (3-0)

Linkages, mobility analysis, Grashof condition, instant centers, analysis and synthesis of mechanisms, cams, gears and gear trains. Prerequisites: MATH 2414, MEEN 2302.

Fee: \$2.00

MEEN 3360 Engineering Design & Sim 3 SCH (3-0)

Introduction to the engineering design process via team-based projects utilizing commercial Computer Aided Engineering software packages. Engineering design process; problem definition, conceptual design, modeling, analysis, system design and optimization. Communicating the design via drawings, models, verbal and written reports. Prerequisites: MEEN 1310, MEEN 1320, and credit or registration in MEEN 3350 and MEEN 3348.

MEEN 3370 Introduction to Electromechanical System Design 3 SCH (2-3)

Introduction to the analysis and design of electromechanical systems containing sensors, actuators, microcontrollers or computers, and mechanical components/mechanisms. Prototyping and construction of such systems. Prerequisites: MEEN 2146, PHYS 2126 and PHYS 2326.

MEEN 3392 Fluid Mechanics 3 SCH (3-0)

Basic properties of fluids. Fluid statics. Fluids in motion. Continuity, energy, and linear and angular momentum equations in integral and differential forms. Incompressible viscous flow; Navier-Stokes equations, parallel flow, pipe flow, and the Moody diagram. Introduction to laminar and turbulent boundary layers and free surface flows. Prerequisites: MATH 3320 and credit or registration in MEEN 2302.

MEEN 3398 Comp App in Nuclear Engr 3 SCH (3-0)

Applications of computer software to solve nuclear engineering problems; nuclear data and cross-section libraries; deterministic and stochastic models; single and multi-objective optimization; applied nuclear engineering codes. Prerequisite: junior standing.

MEEN 4131 Mechanical Engineering Lab 1 SCH (0-3)

Experimental investigation of mechanical engineering systems: engines, fluid flow, and heat transfer systems used in various mechanical engineering applications. Prerequisites: MEEN 2146 and MEEN 3348.

Fee: \$5.00

MEEN 4263 Mech Engr Design Proj I (WI) 2 SCH (1-3)

Capstone design course emphasizing quantitative, analytical/computer and experimental methods, including optimization and simulation, as applied to the design process for a broad range of practical problems in mechanical engineering. Integrates knowledge gained from all required mechanical engineering courses in a major system design project. Prerequisites: senior standing in Mechanical Engineering, ENGL/COMS 2374 or equivalent., MEEN 3348, MEEN 3350 and MEEN 3360, and credit or registration in MEEN 4351.

Fee: \$5.00

MEEN 4264 Mech Eng Design Projects II 2 SCH (1-3)

Capstone design course emphasizing the application of analytical/computer and experimental methods to the solution of a broad range of practical problems in mechanical engineering. Integrates knowledge gained from all required mechanical engineering courses via the completion of a system design project. Prerequisites: MEEN 3325 or equivalent, MEEN 4263 and MEEN 4351.

Fee: \$5.00

MEEN 4301 Design of Aerospace Structures 3 SCH (3-0)

Advanced strength of materials analysis and design of light-weight elastic structures with aerospace applications. Failure modes and criteria, buckling, matrix methods for analysis, plane truss design. Energy and Castigliano methods for statically determinate and indeterminate structures. Torsion and bending of asymmetrical thin-walled sections. Design project. Prerequisites: senior standing in Mechanical Engineering and credit or enrollment in MEEN 3360.

MEEN 4303 Aerodynamics 3 SCH (3-0)

Aerodynamics of airfoils and wings in subsonic, transonic and supersonic flight. Laminar and turbulent boundary layers and effects of viscosity on aerodynamic performance. Prerequisites: senior standing in Mechanical Engineering, MEEN 3347 and MEEN 3392.

MEEN 4305 Aerospace Flight Dynamics 3 SCH (3-0)

Three-dimensional rigid body dynamics, aircraft equations of motion, static and dynamic stability, manual flight control design, introduction to aeroelastic phenomena. Attitude and altitude dynamics, interplanetary transfers, altitude coordinates, stability, manual control, and estimation. Prerequisites: senior standing in Mechanical Engineering and MEEN 2302.

MEEN 4307 Aerospace Systems Design 3 SCH (3-0)

Aircraft/Spacecraft design of systems and subsystems. Preliminary design or study of a complete flight vehicle. Application of mission and spacecraft design principles in developing a space flight mission concept. Prerequisites: senior standing in Mechanical Engineering, MEEN 3352, MEEN 3360, credit or registration in MEEN 4303.

MEEN 4317 Internal Combustion Engines 3 SCH (3-0)

Thermodynamics of cycles, comparison of characteristics and performance of several forms of internal combustion engines including Otto and Diesel types of piston engines. Fuels, combustion, injection and supercharging. Prerequisites: senior standing in Engineering, MEEN 3392 and MEEN 4341.

MEEN 4335 Special Problems 1-3 SCH (1-3)

Individual solution of selected problems in mechanical engineering conducted under direct supervision of a faculty member. May be repeated for up to 6 semester hours. Prerequisite: senior standing.

MEEN 4336 Selected Topics 1-3 SCH (1-3)

One or more topics of mechanical engineering. May be repeated when topic changes. Prerequisite: senior standing.

MEEN 4341 Appl of Thermodynamics 3 SCH (3-0)

Design of power and refrigeration systems, mixing (or separation), multiphase, air conditioning and energy conversion processes. Prerequisites: MEEN 3347 and MATH 3415.

MEEN 4343 Dynamics of Systems 3 SCH (3-0)

Analysis of dynamic-mechanical, electrical, fluid and thermal system elements; modeling, analysis and design of physical, dynamic systems composed of these elements. Prerequisites: senior standing in Mechanical Engineering, MATH 3320, MEEN 1320 and MEEN 2302.

MEEN 4344 Control of Systems 3 SCH (2-3)

Introduction to the analysis and design of linear control systems; time and frequency domain analysis of closed-loop control systems, including steady-state, transient response, and stability. The basic control system design methods, including root locus for basic control actions, such as proportional, integral, and derivative control. Course includes lectures, computational and hands-on lab modules. Prerequisite: senior standing in Engineering. Fee: \$5.00

MEEN 4345 Engineering Vibrations 3 SCH (3-0)

Free and forced vibrations, degrees of freedom, energy methods, transients, harmonic analysis, damping. Prerequisites: senior standing in Mechanical Engineering, MATH 3320 and MEEN 2302.

MEEN 4346 Computatnl Methods in Mech Eng 3 SCH (3-0)

Applications of numerical techniques to the solution of mechanical engineering problems. Prerequisites: senior standing in Mechanical Engineering, MEEN 1320 and credit or registration in MEEN 3348 or MEEN 3350.

MEEN 4347 Hydraulics of Pipeline Systems 3 SCH (3-0)

Design and select hydraulic machines, pipeline, pressure vessels, pumps and control scheme. Understanding of ASME design codes for power and process piping, series and parallel pipe network and pumping power required, and techniques and tools for controlling pipeline network. Prerequisites: senior standing in Engineering and (MEEN 3350 and MEEN 3392) or (AEEN 3303 and CEEN 3392).

MEEN 4348 Gas Dynamics 3 SCH (3-0)

Basic concepts and fundamental equations of gas dynamics. Emphasis on the subsonic and supersonic steady flow. Analysis of shock wave phenomena. Prerequisites: senior standing in Mechanical Engineering, MATH 3320 and credit or registration in MEEN 3348.

MEEN 4349 Air Conditioning 3 SCH (3-0)

Application of factors of temperature and humidity to the design of air conditioning systems. Design and applications of heating and cooling requirements, total energy systems, etc. Prerequisites: senior standing in Engineering, MEEN 3348, and MEEN 4341 or AEEN 3346.

MEEN 4351 Machine Design II 3 SCH (3-0)

Design techniques of brakes, clutches, bevel, worm and helical gears, thick cylinders, flywheels, impact and elastic bodies, curved beams, flat plates and cams. Prerequisites: MEEN 3350 and MEEN 3352. Fee: \$2.00

MEEN 4352 Design of Turbomachinery 3 SCH (3-0)

Design and application of centrifugal and axial flow pumps and turbines, consideration of similarity parameters, real machine performance characteristics, materials and methods of construction, selection process for various applications. Prerequisites: senior standing in Engineering and (MEEN 3392 and MEEN 4341) or (AEEN 3346 and CEEN 3392).

MEEN 4354 Intro to Finite Elem Method 3 SCH (3-0)

Principles and applications of the finite element method. Matrix and vector operations, structure and organization of finite element computer programs. Structural and nonstructural elements and applications. Prerequisites: MEEN 1320, MATH 3320, CEEN 3311 and senior standing.

MEEN 4355 Robotics I 3 SCH (3-0)

Multidisciplinary introduction to robotics, combining concepts from the fields of electrical engineering, mechanical engineering and computer science. Topics include locomotion, maneuverability, actuating, trajectory planning, motion control, and sensing. Prerequisite: senior standing.

MEEN 4371 Introduction to UAVs 3 SCH (3)

Foundations and basic components of Unmanned Aerial Vehicles (UAVs) from a system point of view, design considerations, payloads, communications, control and stability, navigation, UAV system roles and operations, control stations. Prerequisite: senior standing.

MEEN 4372 Resource Optimization for DHS 3 SCH (3-0)

Linear Programming, Simplex Method, Duality Theory and Sensitivity Analysis, The Transportation and Assignment Problems, Network Optimization Models, Dynamic Programming, Integer programming, Game Theory, and Decision Analysis. Prerequisite: senior standing.

MEEN 4373 Info Anal. & Mod. in Sec Eng **3 SCH (3-0)**

Fundamental methods and tools used for information analysis and modeling related to homeland security. It will also introduce engineering and technical challenges of homeland security, including modeling and analysis, technological issues, command, control and situational awareness and data integration requirements. Prerequisite: senior standing in Mechanical Engineering, Electrical Engineering, or Computer Science, or approval from instructor.

MEEN 4382 Polymer Science & Engineering **3 SCH (3-0)**

Structure, synthesis and processing polymers, mechanical, electrical and thermal properties of polymeric materials, applications of polymers and composites. Prerequisites: Senior standing, CEEN 3311, and MEEN 3344.

MEEN 4385 Manufacturing of Composites **3 SCH (2-3)**

Introduction to composites materials and manufacturing processes; hand lay-up, air and oven curing, filament winding and compression molding and 3D printing. Materials selection and fabrication of marine, aerospace, chemical, and civil structures. Practical case studies, use of standards and projects.

Prerequisites: senior standing in Engineering, CEEN 3311, and either CEEN 3244 or MEEN 3344. Fee: \$20.00

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MEEN 4395 Therm Hydr of Nuclear Reactors **3 SCH (3-0)**

Thermal hydraulics of nuclear reactor cores; applications of heat transfer, fluid mechanics, and thermodynamics for nuclear reactor analysis.

Prerequisites: senior standing in engineering, MATH 3320, and (AEEN 3346 or CHEN 3347 or MEEN 3347) and (CEEN 3392 or CHEN 3392 or MEEN 3392).

MEEN 4396 Fundamentals of Nuclear Engineering **3 SCH (3-0)**

Introduction to fundamental concepts of atoms and nuclei, radioactivity, nuclear reactions and interactions with matters, fission, fusion, and radiation biological effect, protection, and applications. Prerequisites: senior standing in engineering or consent of instructor.

MEEN 4397 Intro to Nuclear Power Plants **3 SCH (3-0)**

Introduction to basic topics in the analysis and design of nuclear power plants. Prerequisites: senior standing in engineering, MATH 3320 and PHYS 2326.

MEEN 4399 Internship in MEEN **1-3 SCH (0-1-3)**

Internships in industry, government or consulting companies, designed to broaden the skills obtained through curricular education. Prerequisites: senior standing.

Major

- Industrial Engineering, B.S.
- Mechanical Engineering, B.S.

Minors

- Aerospace Engineering, Minor
- Nuclear Engineering, Minor
- Security Engineering, Minor
- Supply Chain Standards, Minor

Certificates

- Standards for Material Testing, Characterization and Applications, Certificate