

Mechanical Engineering

I. General Purpose

This policy provides a general and detailed description of the educational and research programs of the department of **Mechanical Engineering**. Within this context, the document describes the overall as well as the short and long-term efforts to support the library material and resource needs of the department and its programs.

In general, a systematic effort has been made to acquire major monograph works, relevant proceedings, and core journals that support the primary and secondary research needs of the department and its instructional programs. Among the factors that influence the selection of monographic works are their overall relevance to department programs, potential usage, and state, regional, and national availability. Potential usage is determined by a title-by-title systematic review of Horizon record data in StaffPAC for publications with similar subject coverage. Availability is determined by reviewing the holdings of candidate publications by our state and regional interlibrary loan partners in the OCLC WorldCat database. In addition, ISU interlibrary loan reports are systematically reviewed on a semi-annual basis to identify the current and emerging needs and interests of faculty and staff associated with the department.

In recent years, major electronic abstracts and indexes that support the broad research interests of departmental faculty (i.e., Engineering Village2: Compendex and Mechanical Engineering Abstracts) have been made available, as have electronic versions of core technical journals from a primary society publisher (i.e., American Society of Mechanical Engineers (ASME)). In the coming years, the availability and cost-effectiveness of electronic access to the ASME divisional ASME paper series and subseries will be reviewed.

II. History

Mechanical Engineering was one of the first two engineering programs at Iowa State, having been once incorporated within the original Course in Mechanics (1871). In 1935, Mechanical Engineering instruction at Iowa State was “built upon basic scientific and general courses, followed by the study of heat, power, design, metals, fuels, fluids, and electricity. Further study during the four-year work steer[ed] the prospective graduate toward specific fields, such as manufacturing, power generation, aeronautics, air conditioning, and transportation.” Today, while its curriculum is no longer as broad in scope, the department continues to offer courses that form the core of the discipline: automatic control; fluid flow; heat transfer; heating, ventilating and air conditioning; machine design; mechanical systems; thermodynamics, and tribology.

III. Iowa State University Program

Mechanical engineers are typically involved with the generation, distribution, and use of energy; the processing of materials; the control and automation of manufacturing systems; the design and development of machines; and the solutions to environmental problems. The Department of Mechanical Engineering at Iowa State University has graduated more than 6000 graduates students and each year, more than 100 men and women complete the B.S.M.E. degree requirements.

The Mechanical Engineering department is housed in the H. M. Black Engineering Building (1985) and the Nuclear Engineering Laboratory. The department's research facilities include laboratories for controls, robotics, fluid mechanics, heat transfer, unsteady viscous flows, fluidized bed heat and mass transfer and combustion, powder combustion, electrostatic precipitation, laser applications, material properties, computer-aided manufacturing processes, shock tube studies, thermal/environmental studies, tribology, turbomachinery components, reactor core analysis, reactor thermal hydraulics, nuclear waste management, nuclear fuel cycles, nuclear instrumentation radiation effects on materials, nondestructive examination of materials, reactor kinetics, and control. Among the cross-disciplinary facilities are the Computational Fluid Dynamics (CFD) Laboratory and Virtual Reality Applications Center.

The mechanical engineering core curriculum is designed to expose undergraduate students to each of the three major areas in the field: energy cultivation, manufacturing, and design.

Energy Cultivation

The area of *Energy Cultivation* is concerned with the generation, distribution, and use of energy.

Manufacturing

This area of *Manufacturing* is focused on the processing of raw materials into finished products. Manufacturing systems are implemented by directing the control and automation of the manufacturing process.

Engineering Design and Analysis

The area of *Engineering Design and Analysis* is concerned with the analysis and modeling of complex physical systems according to known mathematical models. Scaled models and computer simulations are commonly employed in these efforts.

The Department of Mechanical Engineering at Iowa State University (ISU) offers programs leading to the degrees of Master of Science and Doctor of

Philosophy in mechanical engineering and nuclear engineering. The graduate program emphasizes advanced study and research in several broad areas:

- **combustion science**
- **computer integrated design and manufacturing**
- **energy conservation, systems, and utilization**
- **fluid mechanics**
- **heat and mass transfer**
- **lasers in manufacturing**
- **mechanisms, dynamic systems, and control**
- **multiphase flows**
- **nuclear engineering**
- **tribology**

In addition to providing instruction in these areas, departmental faculty are engaged in research in these and other areas, including:

- **artificial intelligence**
- **computer-aided design**
- **computational fluid dynamics**
- **fluidized beds**
- **friction and wear**
- **history of science and technology**
- **manufacturing processes**
- **microelectronicmechanical systems**
- **mechatronics**
- **modeling and simulation**
- **nanotechnology**
- **neural networks**
- **nondestructure evaluation**
- **nonlinear control**
- **refrigeration**
- **robotics**
- **synthetic environments**
- **turbulence**
- **virtual reality applications to manufacturing**

Appendix A is a compendium of the specific research interests of departmental faculty.

IV. Subject Boundaries

The research interests of some departmental faculty are more the focus of other ISU departments or programs. A conscious effort is made to purchase publications that support these other research efforts from other appropriate funds or to refer these candidates to the appropriate bibliographer. The major overlapping programs or subject areas and their respective bibliographer are:

- **Aerospace Engineering and Engineering Mechanics / Gerry McKiernan**
- **Automotive engineering / Kris Stacy-Bates**
- **Center for Nondestructive Evaluation (CNDE) / Lorrie Pellack**
- **Chemical Engineering / Gerry McKiernan**
- **Civil Engineering / Kris Stacy-Bates**
- **Computer Science / Gerry McKiernan**
- **Electrical and Computer Engineering / Kris Stacy-Bates**
- **Industrial and Manufacturing Systems Engineering / Gerry McKiernan**
- **Material Science and Engineering / Lorrie Pellack**

Representative textbooks are considered and selectively acquired, particularly those that are a latter edition of titles owned by the ISU library and that have documented use. Proceedings are selectively acquired.

V. General Collection Guidelines

A. Linguistic

English is the primary collection language.

B. Geographical Areas

Nearly all selected material is published in United States or Europe. As with the linguistic parameter, the content of the publication is the basis for considering its selection rather than its geographical origin.

C. Types of Materials Collected

Monographs and serials form the core of the collections that support this program. Significant national and international conference proceedings are also selectively acquired.

D. Format of Materials Collected

The collection is almost entirely paper. A significant number of government publications relevant to the departmental programs (e.g., NASA) are received in microfiche as part of our participation in the federal depository program. A select number of journal are available in electronic form. Two major World Wide Web-based abstract and index database are available – EngineeringVillage2: Compendex and Mechanical Engineering Abstracts.

VI. Specific Collection Guidelines

In general, a conscious effort is made to acquire the monographic and serial literature that supports the broad and specific research interest of departmental faculty.

VII. Detailed Subject Areas

The following is a topical listing characterizes the range and scope of the materials selected and purchased during the past three fiscal years:

Alternative fuels	AutoCAD	Automatic control	Bearings
Boilers	CIM	Combustion	Compressors
Control systems	Controllers	Energy	Engines
Ergonomics	Feedback	Fluid mechanics	Fuzzy control
Gears	Heat transfer	Hydraulics	Intelligent manufacturing
Linear control	Lubricants/Lubrication	Machines	Machining
Manufacturing	Mechanical engineering	Mechanics	Mechatronics
Metalworking	Nanotechnology	Nonlinear control	Nuclear engineering
Piping	Pumps	Rapid prototyping	Refrigerants
Renewable energy	Rheology	Robotics	Sensors
Tribology	Turbines	Turbulence	Vibration

VIII. Other Resources Available

Databases: Aerospace Database ; EiVillage2: Compendex; Mechanical Engineering Abstracts ; NTIS (National Technical Information Service) ; ACM Digital Library ; IEEE Xplore (IEL); Computer and Information Systems Abstracts ; Engineering Materials Abstracts ; MathSciNet ; Science Citation Index.

Among the factors that influence the selection of monographic works are state, regional, and national availability. Availability is determined by reviewing the holdings of candidate publications by our state and regional interlibrary loan partners in the OCLC *WorldCat* database.

IX. Cross-references to Collection Policies

The following subject areas or programs overlap part of the research focus of the Mechanical Engineering department:

- Aerospace Engineering and Engineering Mechanics / Gerry McKiernan
- Automotive engineering / Kris Stacy-Bates
- Center for Nondestructive Evaluation (CNDE) / Lorrie Pellack

- **Chemical Engineering / Gerry McKiernan**
- **Civil Engineering / Kris Stacy-Bates**
- **Computer Science / Gerry McKiernan**
- **Electrical and Computer Engineering / Kris Stacy-Bates**
- **Industrial and Manufacturing Systems Engineering / Gerry McKiernan**
- **Material Science and Engineering / Lorrie Pellack**

X. Creation date

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XI. Revision History

XII. LC Class(es), if applicable.

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XIII. Bibliographer name

Gerry McKiernan

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