FACULTY OF
graduate studies
UNIVERSITY OF MANITOBA

Faculty of Graduate Studies
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The Department of Mechanical and Manufacturing Engineering (known prior to 2005 as the Department of Mechanical and Industrial Engineering and Department of Mechanical Engineering prior to 1990) was established in 1913. The Department's M.Sc. program started in 1957 and the Ph.D. program started in 1968. The graduate student population has grown over the years with a pattern that generally followed the growth pattern for total academic staff (graduate student enrollment of about 3 in the early 1960s to around 80-100 in the 1990s). The Department consists of highly qualified engineers and scientists with interlocking specialization, with doctoral degrees and post-doctoral honours from universities and research institutions around the world. The Department's professor:student ratio in graduate studies is approximately 1:4. Opportunities exist for both basic and applied research projects.

Program Description

The Department has three graduate programs, Master of Engineering (M.Eng.), Master of Science (M.Sc.) and Doctor of Philosophy (Ph.D.). The M.Eng. program is designed for practicing engineers interested in broadening their knowledge through advanced studies. Twenty-four credit hours of course work and six credit hours of project report are required for the degree. The M.Sc. and Ph.D. programs are research oriented with the program offering specialized study in the areas of Thermal Sciences, Fluid Mechanics, Materials Science and Engineering, Applied Mechanics and Design, as well as Manufacturing and Production. The M.Sc. degree requires eighteen credit hours of course work and a research thesis. The Ph.D. program is normally for students who hold a M.Sc. degree. Twelve credit hours of course work and a thesis based on original research are required for the Ph.D. degree. Our objectives are to stay at the forefront of technological knowledge, to contribute to the growth of new technology and to act as a technology resource centre for industry and community at large.

Research Interests

Fluid Mechanics: Concerned with the behaviour of fluids when subjected to pressure gradients. Active research is performed in turbulence, computational fluid dynamics, multiphase flow with droplets and engineering calculations of fluid flow.

Thermal Sciences: Concerned with the application of heat and work to engineering problems. Active research is performed in two phase flow, pool boiling simulation, enhanced heat transfer, solid-liquid phase change, entropy analysis/optimization, combined heat transfer and heat transfer in porous media, droplets vaporization and combustion, reacting and non-reacting spray flows, acoustic wave propagation and supercritical flow stability, ocean hydrothermal energy and minerals research, super-critical properties of ocean hydrothermal fluids, runout table cooling in the steel processing industries.

Material Science and Engineering: Concerned with the behaviour of engineering materials. Active research is focused on deformation studies, joining of aerospace materials, acoustic emission, solidification and diffusion in microgravity, phase transformation in solids, wear and wear protection, processing of polymer composites, durability and interfaces in polymer composites.

Applied Mechanics and Design: Concerned with the analysis and conception of machine and structural components. Active research is performed in biomechanics, solid mechanics, fracture mechanics, fatigue analysis, experimental stress analysis, vibrations and acoustics, kinematics and dynamics of linkage and mechanisms, computer aided design (CAD), and engineering optimization.

Manufacturing and Production: Concerned with analysis design and operation of automated systems and control systems. Active research is conducted in robotics, rapid prototyping, sensor technology, system integration, automatic controls, information systems, human-machine control systems, teleoperation, virtual design and manufacturing, and web-based manufacturing systems. Planning, design and operation of production using queuing theory, networks, scheduling, facilities planning and inventory planning models are also key areas of research.

Research Facilities

Typical research facilities are: fully equipped facility for turbulence measurements; apparatus to study porosity and multiphase flow in porous media; laser-induced fluorescence capabilities; Unix workstations and several high resolution graphics terminals; apparatus for measurement of pressure drop and heat transfer; two-phase flow regimes during condensation and many more; computer controlled x-ray diffratometer, TEM, SEMs, optical image analyzer, mechanical testing systems, constant stress creep machines, Hopkinson bar high-strain rate deformation systems; corrosion testing and research facilities; facilities related to processing and manufacture of polymeric composites; laser optics laboratory comprising a vibration-free optical bench; a 10 ton high frequency resonant fatigue machine; analog-digital facilities for the analysis of acoustic and vibration signals; advanced manufacturing cells under full control of personal computers; a rapid prototyping system with a SLA3500 Stereolithography machine; a teleoperated hydraulic MK-II Unimate manipulator; a hydraulic test station for force/motion control studies; Electromyography (EMG) systems; high speed computer workstations for computational simulations, water and spray/wind tunnels with Particle Image Velocimetry and flow visualization, pulsed and continuous wave laser systems.

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