WISCONSIN
UNIVERSITY OF WISCONSIN–MADISON

Department of Engineering
Professional Development

The University of Wisconsin–Madison offers courses at your location focusing on heat transfer and engine cooling. Curriculum for course topics is designed by UW–Madison faculty and industry experts, and in cooperation with the Engine Research Center (ERC). The University's ERC has a long and distinguished record of research and education pertaining to internal combustion engines and advanced propulsion systems.

Our staff will work with you to tailor our programs to meet your development goals.

Heat Transfer and Engine Cooling

Topic *(Each session is approximately 1 hour 10 minutes)*	**Four-day course**	**Three-day course**	**Two-day course**
Introduction	X	X	X
Heat Transfer Review, with Engine Application ■ Tracking the energy transfer ■ In-cylinder heat transfer ■ Measurements versus crank angle ■ Port heat transfer	X	X	
Thermal Mapping and Measurement Techniques ■ Approaches to temperature measurement ■ Component temperature mapping ■ Boundary conditions, analysis, and validation	X	X	
Critical Temperatures in Engines I ■ Component fatigue ■ Transient loads and thermal shock ■ Gasket load control	X	X	X
Critical Temperatures in Engines II ■ Deposit control ■ Thermal distortion and controlling dimensions ■ Oil life	X	X	X
Thermal Fatigue Analysis ■ Cylinder heads ■ Head gaskets ■ Exhaust ports and manifolds ■ Pistons and rings	X		
Approaches to Cooling ■ Water cooled system features ■ Engine cooling circuits and trade-offs ■ Air cooled engines ■ Alternative systems	X	X	X
Coolants ■ Chemical formulation and mixtures ■ Coolant performance characteristics ■ Additives and filtration	X	X	X
Cooling Jacket Development I ■ Coolant velocity control ■ General circuit considerations ■ Adjustments and cylinder balance	X	X	X
Cooling Jacket Development II ■ Cylinder cooling considerations ■ Head cooling considerations ■ Cooling jacket venting ■ Experimental and computational methods	X	X	

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Heat Transfer and Engine Cooling *continued*

Topic *(Each session is approximately 1 hour 10 minutes)*	**Four-day course**	**Three-day course**	**Two-day course**
Cooling System Components ■ Water pump design and performance ■ Electric pumps ■ Thermostats and advanced control techniques	X	X	X
Heat Exchangers ■ Types of heat exchangers ■ Performance measures ■ Design and manufacture	X		
Cooling Circuit Layout Considerations ■ Cooling circuits and vehicle considerations ■ Vehicle system integration ■ Filling and venting	X	X	X
Cooling Circuit Analysis ■ Cooling system sizing ■ Circuit analysis and testing ■ De-aeration	X		
Air-Side Development ■ Overview of parameters and constraints ■ Fan characteristics ■ Heat exchanger packaging ■ Engine compartment flow and temperature control	X	X	

For more information about courses available at your site, including optimal group size and costs, contact:

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