WISCONSIN
UNIVERSITY OF WISCONSIN–MADISON

Department of Engineering
Professional Development

The University of Wisconsin–Madison offers courses at your location focusing on reliability and engine development. 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.

Reliability and Engine Development

Topic *(Each session is approximately 1 hour 10 minutes)*	**Five-day course**	**Four-day course**	**Three-day course**	**Two-day course**
Introductory Concepts ■ Engine development overview ■ Fatigue, wear, and leaks ■ Experimental and analytical approaches	X	X	X	X
Reliability ■ The bathtub curve ■ Weibull analysis ■ System and component life characterization	X	X	X	X
Accelerated Testing ■ Objectives ■ Life characterization models ■ Practical approaches	X	X	X	X
Fatigue in Engine System Development ■ Overview of high- and low-cycle fatigue analysis ■ Fatigue life determination ■ Application to engine components	X	X	X	X
Crankshaft System Analysis ■ Fillet stress and crank throw development ■ Crank system design ■ Nose and flange design ■ Connecting rod development	X	X	X	
Torsional Analysis ■ Forcing functions ■ System response ■ Approaches to damping	X			
Structural Development ■ Cylinder block load paths ■ The head gasket seal ■ Thermal loads and cylinder head development	X	X	X	X
Gasketed Joints and Seals ■ Gasketed joint design considerations ■ Bolt load control ■ Shaft seal development	X	X		
Piston Structural Development ■ Design approaches and materials ■ Temperature control and crown development ■ Pin boss development	X	X	X	
Wear in Engine Development ■ Mechanisms of wear in the engine ■ Adhesive wear and friction ■ Wear characterization and validation	X	X	X	X

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Reliability and Engine Development *continued*

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Deposit Formation Mechanisms ■ Chemical reaction mechanisms ■ Kinetic models ■ Temperature regimes, deposit types, and control	X			
Engine lubricants ■ Conventional and synthetic lubricants ■ Additive packages ■ Lubricant performance measures	X	X		
Lubrication Systems ■ Splash and pressurized lubrication systems ■ Lubrication layout considerations ■ Sump design and dry sump systems ■ Drain-back	X	X	X	X
Lube System Layout and Analysis ■ System requirements and pump sizing ■ Bearing flow ■ Hydraulic lifters ■ Piston cooling	X			
Piston Lubrication Development ■ Temperature control ■ Ring land development ■ Secondary motion and skirt loading	X	X	X	
The Ring Pack ■ Ring design and operation ■ Ring wear ■ Ring dynamics and ring-pack development	X	X	X	
Cylinder Wall Development ■ Design approaches, materials, and coatings ■ Cylinder wall surface characteristics ■ Cylinder wall distortion and its control	X	X	X	X
Introduction to Bearings ■ Hydrodynamic bearing operation ■ Film pressure and oil film thickness ■ Oil supply drillings, location, and bearing grooves ■ Split-shell bearing design	X	X	X	X
Bearing Sizing Analysis ■ Calculating bearing forces ■ The Sommerfeld number and bearing sizing ■ Computational tools for hydrodynamic and elastohydrodynamic ■ Block dynamics and coupled analysis ■ Experimental techniques	X	X		
Bearing Materials and Development ■ Bearing material requirements ■ Wear and failure mechanisms ■ Bearing construction and properties	X	X	X	

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Developing Mixed Film Interfaces ■ Motion analysis and measurements ■ Load distribution ■ Material selection ■ Wear characterization	X	X		
Valvetrain Development ■ Camshaft wear mechanisms ■ Valve and seat wear ■ Valvetrain component wear and lash	X	X	X	X
Engine Break-In Considerations ■ What happens during break-in ■ Conformance ■ What can go wrong? ■ Approaches	X	X		

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

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