



WISCONSIN
UNIVERSITY OF WISCONSIN-MADISON

Department of Engineering
Professional Development

The University of Wisconsin–Madison offers courses at your location focusing on engine wear, lubrication, and bearings. 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.

Engine Wear, Lubrication, and Bearings				
Topic (Each session is approximately 1 hour 10 minutes)	Four and ½-day course	Four-day course	Three-day course	Two-day course
Introductory Remarks <ul style="list-style-type: none"> • Friction, lubrication, and wear • Lubrication system objectives • Development overview 	X	X	X	X
Reliability <ul style="list-style-type: none"> • The bathtub curve • Weibull analysis • System and component life characterization 	X			
Accelerated Testing <ul style="list-style-type: none"> • Objectives • Life characterization models • Practical approaches 	X			
Wear in Engine Development <ul style="list-style-type: none"> • Mechanisms of wear in the engine • Adhesive wear and friction • Wear characterization and validation 	X	X	X	X
Friction Measurement and Analysis <ul style="list-style-type: none"> • Global measurements • Component and sub-system measurements • Analysis and data fidelity 	X	X		
Deposit Formation Mechanisms <ul style="list-style-type: none"> • Chemical reaction mechanisms • Kinetic models • Temperature regimes, deposit types, and control 	X	X		
Engine Lubricants <ul style="list-style-type: none"> • Conventional and synthetic lubricants • Additive packages • Lubricant performance measures 	X	X	X	X
Lubrication Systems <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • System requirements and pump sizing • Bearing flow • Hydraulic lifters • Piston cooling 	X	X	X	X
Crankcase Breathing <ul style="list-style-type: none"> • The crankcase environment and oil aeration • Windage and bay-to-bay breathing • Breathers and positive ventilation systems 	X	X	X	X



Engine Wear, Lubrication, and Bearings *continued*

Topic (Each session is approximately 1 hour 10 minutes)	Four and ½-day course	Four-day course	Three-day course	Two-day course
Lube System Component Development <ul style="list-style-type: none"> ▪ Pump and regulator design and performance ▪ Filtration ▪ Oil cooler use and design 	X	X	X	
Introduction to Bearings <ul style="list-style-type: none"> ▪ 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 <ul style="list-style-type: none"> ▪ Calculating bearing forces ▪ The Sommerfeld number and bearing sizing ▪ Computational tools for hydrodynamic and elastohydrodynamic ▪ Block dynamics and coupled analysis ▪ Experimental techniques 	X	X	X	
Bearing Materials and Development <ul style="list-style-type: none"> ▪ Bearing material requirements ▪ Wear and failure mechanisms ▪ Bearing construction and properties 	X	X	X	
Developing Mixed Film Interfaces <ul style="list-style-type: none"> ▪ Motion analysis and measurements ▪ Load distribution ▪ Material selection ▪ Wear characterization 	X	X	X	
The Cylinder Wall, Rings, and Pistons <ul style="list-style-type: none"> ▪ Objectives and surface characteristics ▪ Honing processes ▪ Bore distortion and control ▪ Piston skirt profiling ▪ Ring pack operation 	X	X	X	X
Engine Break-In Considerations <ul style="list-style-type: none"> ▪ What happens during break-in ▪ Conformance ▪ What can go wrong? ▪ Approaches 	X	X		
Presentation of Recent Studies <ul style="list-style-type: none"> ▪ Block bending and crankshaft loading ▪ Bearing analysis techniques ▪ Lube pump development 	X	X		

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

Michael J. Andrie, Program Director

Phone: 800-462-0876; 608-263-1615

Email: mandrie@wisc.edu

Website: epd.engr.wisc.edu/2012onsiteengine