ME 4610/5610
Advanced Machining Processes
Course Schedule
Spring 2009

Day	(#)	Topic (Slide #)	Description	# Lec.	Assignments
M 01/12		Course Information 1.1 General Terminology (1–7)	Format, Grading, Policies, Goals, Expectations Machine-tool system breakdown and related terms	2/3 1/3	**Lab**: Cancelled
W 01/14	(1)	1.2 Motivation for Process Modeling (8–12) 1.3 Economics (13–16) 1.4 The Mechanistic Modeling Approach (17–22)	How, when and where process models are used Market and machining economics considerations Complex vs. simple models and a compromise	1/3 1/3 1/3	
F 01/16	(2)	2.1 Orthogonal Cutting Process Geometry (27–37)	Real process vs. that assumed for modeling and analysis Fundamental process geometry Velocity relations	1/3 1/3 1/3	
M 01/19	(3)	MLK Day	No Lecture		Also read Sec. 1.5, Static vs. Dynamic Modeling (23-26) **Lab**: Review of Common Machine Tools & Machining Processes
W 01/21	(4)	2.2 Chip Characterizations (38–43)	Example(s) Classifications/types of chips and their descriptions Show & Tell — Chips	1/3 1/3 1/3	
F 01/23	(5)	2.3 Force – Process-Geometry Relations (44–54)	Mathematical relations and geometrical diagram method Example(s)	2/3 1/3	Assign HW1
M 01/26	(6)	2.4 Stress and Strain (55–64)	Shear plane stresses and force-strength problems Mohr's Circle interpretation Rake face stresses and force-strength problems	1/3 1/3 1/3	**Lab**: Exp. 1 — Magnified Orthogonal Cutting of Clay
W 01/28	(7)	Quiz 1 2.4 Stress and Strain, cont'd (65–69)	 Shear strain visualization and quantification Example(s)	1/3 1/3 1/3	
F 01/30	(8)	2.5 Specific Energy and Force Prediction (70–79)	Power, machinability and material removal rate Merchant's energy analysis	2/3 1/3	
M 02/02	(9)	2.5 Specific Energy and Force Prediction, cont'd (80–92)	Force modeling Size effect in metal cutting	1/3 2/3	*HW1 Due* Assign HW2 ***Lab**: Exp. 1 Report Due in Lab* **Lab**: Exp. 2 — Orthogonal Cutting (set-up and description)

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W 02/04 (10)	2.5 Specific Energy and Force Prediction, cont'd 2.6 Empirical Specific Energy Modeling (93–96)	Example(s) Model forms	2/3 1/3	
F 02/06 (11)	Winter Carnival	Stay Warm!		
M 02/09 (12)	2.6 Empirical Specific Energy Modeling, cont'd (97–100)	Model forms, cont'd Interpretation of effects Statistical significance	1/3 1/3 1/3	*HW2 Due* Assign HW3 **Lab**: Cancelled – Winter Carnival + Testing for Exp. 2
W 02/11 (13)	Quiz 2 3.1 The Oblique Cutting Process (101–109)	 Tool orientation and rake angles Flow angles and chip ratio	1/3 1/3 1/3	
F 02/13	Catch up			
M 02/16 (14)	3.1 The Oblique Cutting Process, cont'd (110–118)	Velocities and effective angles Oblique cutting props Force relations	1/3 1/3 1/3	*HW3 Due* Assign HW4 Read slides 119-122 **Lab**: Design of Experiments
W 02/18 (15)	3.2 The Turning and Facing Processes (123–133)	3-D geometry and relation to 2-D orthogonal cutting Inclination and rake angles	2/3 1/3	Review slides 131–133
F 02/20 (16)	3.2 The Turning and Facing Processes, cont'd (134–141)	3-D edge representation for zero corner radius 3-D edge representation for non-zero corner radius	2/3 1/3	
M 02/23 (17)	3.2 The Turning and Facing Processes, cont'd (142–148)	Force model calibration Force relations	1/3 2/3	*HW4 Due* Assign HW5 ***Lab**: Exp. 2 Report Due in Lab* **Lab**: Exp. 3 — Magnified Corner-Radiused Cutting of Clay
W 02/25 (18)	Quiz 3 3.2 The Turning and Facing Processes, cont'd (149–163)	 Equivalent lead angle and simple prediction methods More complex equivalent lead angle prediction methods	1/3 1/3 1/3	
F 02/27 (19)	3.2 The Turning and Facing Processes, cont'd (164–174)	Mechanistic modification of the size-effect method Summary of key concepts and material removal rate The facing process	2/3 1/3	
M 03/02 (20)	3.3 The Boring Process (175–186)	Similarity to and difference from turning Forces	1/3 2/3	*HW5 Due* ***Lab**: Exp. 3 Report Due in Lab* **Lab**: Exp. 4 — Force Prediction for Corner-Radiused Tools (set-up and description)

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W 03/04 (21)	**Exam 1**	Covers Chapters 1.1–3.2 (HW1–5; Q 1–3) Review session (Mon. 02/28, 9 p.m.)		
F 03/06 (22)	3.4 Modeling the Effects of Runout (187-198)	Feed and depth throw Axis offsets and tilt	2/3 1/3	
M 03/09	Spring Break	Relax and Enjoy!		
W 03/11	Spring Break	Relax and Enjoy!		
F 03/13	Spring Break	Relax and Enjoy!		
M 03/16 (23)	4.1 The Face Milling Process (199–215)	Similarity to and difference from turning and boring Tooth-local and global forces	1/3 2/3	**Lab**: Testing for Exp. 4
W 03/18 (24)	Return Exam 1 4.1 The Face Milling Process, cont'd (216–218)	 Miscellaneous factors that affect forces	2/3 1/3	Assign HW6
F 03/20 (25)	4.2 The End Milling Process (219–232)	Basics — multi-tooth, where cutting occurs, geometry Force transformations Dependence on axial position	1/3 1/3 1/3	
M 03/23 (26)	4.2 The End Milling Process, cont'd (231–240)	Axial Integration recap Axial integration details Miscellaneous — runout and ball end milling	1/3 1/3 1/3	**Lab**: Testing for Exp. 4
W 03/25 (27)	Quiz 4 4.3 The Drilling Process (241–247)	 Basic drill geometry specifications The radial coordinate	1/3 1/3 1/3	
F 03/27 (28)	4.3 The Drilling Process, cont'd (248–262)	Cutting process angles Similarity to and difference from boring – force transformations and integration along the edge The oblique equivalent and summary	1/3 1/3 1/3	
M 03/30 (29)	5.1 Overview of Machined Surface Characterization (263–267)	Overview of remainder of course Functional performance issues	1/3 2/3	*HW6 Due* Assign HW7 Assign Final Project ***Lab**: Exp. 4 Report Due in Lab* **Lab**: Exp. 5 — Milling Force Prediction
W 04/01 (30)	5.1 Overview of Machined Surface Characterization, cont'd (268–272) 5.2 Surface Error Components (273–275)	Production and product costs Surface integrity and quantifying surface error Effects of process inputs	1/3 1/3 1/3	

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F 04/03 (31)	5.2 Surface Error Components, cont'd (276–284)	Form error Waviness Roughness	1/3 1/3 1/3	
M 04/06 (32)	5.2 Surface Error Components, cont'd (285–286) 5.3 Surface Characterization Parameters (287–296)	Lay; discrete vs. continuous characterization Characterization parameters Roughness parameter quantification	1/3 1/3 1/3	*HW7 Due* Assign HW8 ***Lab**: Exp. 5 Report Due in Lab* **Lab**: Exp. 6 — Surface Error in Turning (set-up and description)
W 04/08 (33)	Quiz 5 Final Project 5.4 Turning, Boring, Drilling and Face Milling (297–302)	 Questions, guidance, etc. Zero and Non-zero corner radius	1/3 1/3 1/3	
F 04/10 (34)	Final Project 7.1 Tool Wear in Cutting (323–330)	Questions, guidance, etc. Wear zones Tool failure and wear mechanisms	1/3 1/3 1/3	
M 04/13 (35)	Final Project 7.2 Tool Life Models for Cutting (331–338)	Questions, guidance, etc. Wear curves Tool life modeling	1/3 1/3 1/3	*HW8 Due* Assign HW9 **Lab**: Testing for Exp. 6
W 04/15 (36)	Final Project 7.3 A Time, Cost and Profit Model (339–347)	Questions, guidance, etc. Machining and engagement times Unit time, cost and profit rate	1/3 1/3 1/3	
F 04/17 (37)	7.3 A Time, Cost and Profit Model, cont'd (348–354) 7.4 Economics-Based Optimization (355–364)	Dealing with intermittent processes Minimizing and maximizing	1/3 1/3 1/3	
M 04/20 (38)	Final Project 7.4 Economics-Based Optimization, cont'd (365–370) 8.1 Chip Control (371–376)	Questions, guidance, etc. Maximizing profit rate and summary Chip breaker styles and breaking chips	1/3 1/3 1/3	*HW9 Due* Assign HW10 ***Lab**: Exp. 6 Report Due M/W*
W 04/22 (39)	Quiz 6 Final Project Course Evaluations	 Questions, guidance, etc. Valued feedback!	1/3 1/3 1/3	
F 04/24 (40)	8.3 Vibration and Chatter (387–398)	Forced response Self-excited response Chatter	1/3 1/3 1/3	*HW10 Due*
Final Ex. Day	**Exam 2**	Covers Chapters 3.3–7.5 (HW6–10; Q 4–6) Review session (TBD)		

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W 04/29	All Done!			***Final Project Due by 5:00 p.m.***