

**UNIVERSITY OF CALIFORNIA, DAVIS**  
**Department of Materials Science and Engineering**

**Prof. Gibeling**

**EMS-274**

**Winter 2017**

COURSE INFORMATION

Course Title:       Advanced Mechanical Properties of Materials

Instructor:         Prof. Jeffery C. Gibeling  
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Office Hours:      MWF 1:00PM-2:00PM (and by arrangement)

Course Meetings:   MTWR 9:00-9:50, 1070 Bainer Hall

Textbook:          M. A. Meyers and K. K. Chawla, Mechanical Behavior of Materials, Second Edition,  
Cambridge University Press, Cambridge, 2009.

Grading Basis:     Homework (4-5 assignments)                     20%  
                          Term Paper (due Monday, Mar. 13)                     30%  
                          Final Exam   50%

References:         Please see separate list.

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COURSE OUTLINE AND READING ASSIGNMENTS

<u>Date</u>	<u>Lecture Topic</u>	<u>Assignment*</u>	
		<u>Chap.</u>	<u>Pages</u>
Jan. 9	Introduction to Mechanical Properties	1	1-64
Jan. 10	Elastic Properties of Solids; General States of Stress and Strain	2	71-89
Jan. 11	Anisotropic Linear Elasticity	2	95-107
Jan. 12	Elastic Properties of Polycrystalline Materials and Composites	2	107-120
		15	765-779
Jan. 16	MARTIN LUTHER KING HOLIDAY	*	*****
Jan. 17	Elastic Modulus and Atomic Bonding	2	145-155
Jan. 18	Elastic and Anelastic Properties of Polymers and Glasses	2	120-143
Jan. 19	Plastic Deformation of Crystalline Solids	4	251-254
Jan. 23	Dislocation Geometry and Density	4	266-273
Jan. 24	Stress Fields of Dislocations	4	273-278
Jan. 25	Dislocation Line Energy and Line Tension	4	278-283
Jan. 26	Dislocation Glide Movement	4	298-313
Jan. 30	Dislocation Climb Movement	-	-----
Jan. 31	Forces on Dislocations	4	283-284
Feb. 1	Forces on Dislocations in Finite Bodies	-	-----
Feb. 2	Influence of Crystal Structure on Dislocation Geometry	4	284-298
Feb. 6	Influence of Crystal Structure on Dislocation Geometry	-	-----
Feb. 7	Plasticity in Single Crystals	6	369-384
Feb. 8	Plasticity in Polycrystalline Materials	-	-----
Feb. 9	Strengthening Mechanisms: Grain Boundaries	5	321-327
		5	345-364
Feb. 13	Strengthening Mechanisms: Work Hardening	6	384-399
Feb. 14	Strengthening Mechanisms: Particles	10	558-590
Feb. 15	Deformation Twinning	5	336-344
Feb. 16	Mechanical Testing: Tension and Compression	3	161-199
Feb. 20	PRESIDENTS' DAY HOLIDAY	*	*****
Feb. 21	Mechanical Testing: Hardness	3	214-228
Feb. 22	Phenomenological Correlations of Creep Deformation	13	653-665
Feb. 23	Creep Mechanisms in Crystalline Solids	13	665-676
Feb. 27	Creep Mechanisms in Crystalline Solids	-	-----
Feb. 28	Creep Strengthening Mechanisms	-	-----
Mar. 1	Creep Mechanisms in Polymers and Glasses	13	688-704
Mar. 2	Fracture: Cracks and the Griffith Criterion	7	404-420
Mar. 6	Linear Elastic Fracture Mechanics	7	421-428
Mar. 7	Crack Tip Plasticity	7	428-433
Mar. 8	Fracture Toughness	7	434-443

Mar. 9	Crack and Toughening Mechanisms: Ductile Materials	7	445-447
		8	466-487
Mar. 13	Crack and Toughening Mechanisms: Brittle Materials	8	487-507
Mar. 14	Fracture Testing: Ductile Materials	8	532-538
Mar. 15	Fracture Testing: Brittle Materials	8	545-551
Mar. 16	Review	-	-----

FINAL EXAMINATION: Monday, March 20, 2017, 8:00-10:00 AM (tentative)  
NOTE: Students from Livermore should plan to take the test in Davis.

\* All reading assignments are from the text by Meyers and Chawla, Second Edition