**ICME 8990**

**8990 – *Integrated Computational Materials Engineering for Metals*: Classes**

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| **DATE** | **LSN** | **TOPICS** | **Notes/Book Chapter** | **WHAT'S DUE?** |
|
|  |  | *Section 1. Background Material* |  |  |
| 8/17 | 1 | Introduction and Overview | Syllabus, NAS Report | Project team names |
| 8/19 | 2 | Multiscale Modeling and Bridging Methods | ICME Ch. 1 |  |
| 8/21 | 3 | History Modeling and Examples | Simulation-Based Design Paper |  |
| 8/24 | 4 | Design Optimization and Uncertainty |  |  |
| 8/26 | 5 | Material Failure Analysis Process |  |  |
| 8/28 |  | Conceptual quiz 1 |  | Project 1 proposal due |
|  |  | *Section 2. Macroscale Modeling-Plasticity and Fracture* | ICME Ch. 2 |  |
| 8/31 | 6 | Indicial Notation |  |  |
| 9/2 | 7 | Stress and Strain |  |  |
| 9/7 | 8 | Constitutive Relations |  |  |
| 9/9 | 9 | Introduction to Internal State Variable Theory |  |  |
| 9/11 | 10 | Plasticity ISV Theory |  |  |
| 9/14 | 11 | Plasticity ISV Tutorial |  |  |
| 9/16 |  | Conceptual Quiz 2: Macroscale |  |  |
| 9/18 | 12 | Damage ISV Theory |  |  |
| 9/21 | 13 | Damage ISV Tutorial |  |  |
| 9/23 | 14 | MultiStage Fatigue (MSF) Theory |  |  |
| 9/25 | 15 | MultiStage Fatigue Tutorial |  |  |
| 9/28 | 16 | Image Analysis methods |  |  |
| 9/28 |  | Conceptual Quiz 3: Macroscale Fracture/Fatigue |  |  |
|  |  | *Section 3. Mesoscale: Crystal Plasticity* | ICME Ch. 3 |  |
| 9/30 | 17 | Kinematics |  |  |
| 10/2 | 18 | Hardening Rules: Upscaling/Downscaling |  |  |
| 10/7 | 19 | Damage |  |  |
| 10/9 | 20 | Fatigue |  |  |
| 10/12 |  | Conceptual Quiz 4: Mesoscale: Crystal Plasticity |  |  |
|  |  | *Section 4: Microscale: Dislocation Dynamics* | ICME Ch. 4 |  |
| 10/14 | 21 | Atomic Crystals and Defects |  |  |
| 10/19 | 22 | Atomic Defects/Dislocations: Upscaling/Downscaling |  |  |
| 10/21 | 23 | Damage |  |  |
| 10/23 | 24 | Fatigue |  |  |
| 10/23 |  | Conceptual Quiz 5: Microscale: Dislocation Dynamics |  |  |
|  |  | *Section 5: Nanoscale: Atomistic Methods* | ICME Ch. 5 |  |
| 10/26 | 25 | EAM/MEAM: Downscaling |  |  |
| 10/28 | 26 | MD/MS/MC Methods |  |  |
| 10/30 | 27 | Plasticity: Upscaling |  |  |
| 11/2 | 28 | Damage |  |  |
| 11/4 | 29 | Fatigue |  |  |
|  |  | Conceptual Quiz 6: Nanoscale |  |  |
|  |  | *Section 6: Electronics Scale* | ICME Ch. 6 |  |
| 11/6 | 30 | Schrodinger Equation |  |  |
| 11/9 | 31 | Density Functional Theory |  |  |
| 11/13 | 32 | DFT Upscaling |  |  |
| 11/16 |  | Conceptual Quiz 7: Electronics Scale |  |  |
|  |  | *Section 7: Case Studies* |  |  |
| 11/18 | 33 | Cadillac Control Arm Fracture | ICME Ch. 7 |  |
| 11/20 | 34 | Cadillac Control Arm Fatigue | ICME Ch. 8 |  |
| 11/23 | 35 | Forming Problem | ICME Ch. 9 |  |
| 11/25 | 36 | Creation of New Materials | ICME Ch. 10 |  |
| 11/30 |  | **Project Presentations** |  | **Project Due 12/4/2009** |
| 12/4 |  | **Project Presentations** |  | **Project Due 12/4/2009** |
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