**2019F-MSE\_1070 MECHANICAL BEHAVIOR OF MATERIALS**

**Course Syllabus Fall 2019**

**Description**

Continuum mechanics concepts; stress, strain, tensor notation, and equations of equilibrium; comparison of materials behavior: bonding, structure and properties of metals, ceramics, and polymers; constitutive relations: linear and non-linear elasticity, and plasticity; time-dependent deformation: visco-elasticity, mechanical analogs, vibrations and damping, anelasticity, creep, stress-rupture, and deformation mechanism maps; fracture under monotonic loading conditions: brittle, ductile, ductile-to-brittle transition, role of structure, role of stress state, fracture mechanisms, fractography, fracture mechanics, notched-bar impact test, methods of increasing resistance to brittle and ductile fracture; fracture under cyclic loading conditions: fatigue testing, statistical treatment of failure data, S-N curves, strain-life diagrams, low and high-cycle fatigue, and materials/component design concepts for increased resistance to fatigue failure.. (3 credits)

### COURSE OUTLINE

1. Mechanical Fundamentals 2. Constitutive Relations

Stress Linear Elastic

Strain Plastic

Tensors Non-linear Elastic

Equilibrium Newtonian Flow

1. Elasticity 4. Plasticity

Linear and Non-linear Yield Criteria

Isotropic and Anisotropic Isotropic and Anisotropic

Wave Motion in Elastic Solids Texture Hardening/Softening

Constitutive Equations Sheet Metal Forming

Forging

Rolling

5. Viscoelasticity 6. Fracture

Time-dependent Deformation Brittle & Ductile

Physical Basis/ Polymers Mechanisms

Mechanical Analogs Fracture Mechanics

Vibrations and Damping Fatigue

Creep

# Schedule: Tuesdays 8:15-11:00am, Lecture Room Zone 4-204

# Instructor: Prof. Charles Hua charleshua@scu.edu.cn

17760422493 (WeChat)

**Teaching Assistant:** Qiaoting He [heqiaoting89@qq.com,](mailto:heqiaoting89@qq.com>,) 18428389194@163.com

When emailing the instructors and/or TA, include “MSE1070” in the subject field of your message. Use your university email account (student\_ID\_number@stu.scu.edu.cn); mail from other accounts might be stopped by the SCU spam filter.

# Textbook

G. E. Dieter, ***Mechanical Metallurgy*** , 3 rd Edition, 1986, Mc Graw-Hill, New York.

* It is assumed that the student has a basic working knowledge of:
  + **Phase diagrams:** reading and understanding the diagrams, identifying phases and eutectics, solubility and relative composition of phases
  + **Basic kinetics:** equilibrium cooling (i.e. through a phase boundary) and time-temperature-transformation diagrams
  + **Microstructure:** Phases, eutectics, lamellae, connection to phase diagrams and kinetics

If these terms are fuzzy to you, review your course notes. If they are totally unfamiliar, beware…

# Web Site

This course uses the Blackboard system; the web site is

**https://learn.scupi.cn/**

(Note: the **https** is important, otherwise it may not load.) There you will find the course syllabus, homework assignments, and other materials. Current announcements and assignments will be posted on the home page. All assignments will be uploaded through the Blackboard system. Please check the class page frequently.

# Class Format

This course is taught using a combined lecture, reading, review and discussion format. The class begins with two session lecture to review material in the literature and introduce new concepts. In the third session, the lecturer may ask questions to as many students as possible and encouraging critical reading of published papers in related field.

**It is imperative that you come to class prepared.** This will generally involve reading all posted literature and viewing tutorial videos. This is a three credit hour class, which means you should expect to devote at least 9 to 12 hours of effort outside the scheduled class time every week.

# Homework Assignments

Homework problems will be assigned every three week and posted on Blackboard. These are to be completed and turned in by **Tuesday 1:30 PM** the following week. You may work with other people on homework, but all writeups must be individual efforts. Homework will be graded on a 0-100 point scale.

All work will be submitted electronically through the Blackboard system. Late homework will not be accepted.

Unless specifically requested, emailed homework will not be accepted.

Please adhere to these homework guidelines:

* Your assignment must be typeset using Word and submitted electronically through Blackboard. Handwritten assignments will not be accepted.
* Put your name, ID number (last four digits), and class section at the top of the first page.
* List the names of other people you've worked with on the assignment or report.

All of the homework scores will be used in your grade computation. Unless otherwise indicated, you can work with your fellow classmates in the class, but you must submit a distinct and independent write-up to receive credit.

If you’re sick, or have a compelling emergency that prevents you from turning in the homework on time, email Prof. Charles Hua.

If you believe an error has been made in the grading of an assignment, bring it to the attention of your TA within ONE WEEK of its return.

The first homework submitted late with a legitimate excuse will receive half credit; all subsequent late homework will receive zero credit.

# Grading

Homework (30%), class participation (20%), mid-term exam (20%), and final examination (30%).

If your homework is submitted late, you lose 10% of the credits per day past due, and have zero credit one week past due. You should participate actively in the class in order to grasp the important concepts. If you are found using cellphone or playing video games in the classroom during the lecture hours, you will lose the participation credits.

# Office Hours

If you don’t understand something, and talking to your classmates doesn’t help, then you should be seeking help from the instructor or teaching assistant.

Office hours are times we have specifically set aside to be available to students. During office hours, you can come to our office; you don’t need an appointment. We are also available at other times; please email to schedule a time.

Current office hours will be Monday and Tuesday afternoon, 1-6pm, zone 4 -226.