Course alpha, number, title

ME 222 Mechanics of Deformable Solids

Required or elective

Required

Course (catalog) description


Prerequisite(s)

(MTH 234 and ME 221)

Textbook(s) and/or other required material


Plus ME222 Laboratory Manual, ME Dept., Michigan State University, on-line.

Class/Lab schedule:

Total Credits: 4 Lecture/Laboratory/Discussion Hours: 3/2/0

Topics covered

(a) normal and shear stress
(b) normal and shear strain
(c) stress at a point
(d) St. Venant principle
(e) bars with axial loads
(f) thermal stress
(g) principal and max shear stresses,
(h) Mohr circle
(i) statically indeterminate axial members
(j) pressure vessels
(k) stress concentrations
(l) torsion of circular bars
(m) statically indeterminate torsion
(n) torsion of thin-walled tubes
(o) review of shear and moment diagrams
(p) flexure stress
(q) beam shear stress
(r) beam deflection
(s) statically indeterminate beams
(t) yield and failure criteria
(u) Elastic stability

Course learning objectives

The student will be able to:

1. explain the concepts of stress and strain and their relationships to load and deformation, and use the concepts in the solution of problems;
2. calculate stresses and deformations in machine and structural components including:
   a. axially-loaded bars
   b. components in pure shear
   c. circular shafts in torsion
   d. beams in bending
   e. beams in shear
   f. thin-walled beams
   g. thin-walled pressure vessels
   h. combined loading problems;
      i. statically indeterminate components including beams, shafts, axial loads.
3. compute the principal stresses, principal angles, maximum shear stress and angles, and stresses on any arbitrary plane, given the state of stress at a point;
4. explain the concept of elastic stability and why it is important, and calculate critical buckling loads for basic cases of axially-loaded slender bars;
5. utilize strain gages and associated instrumentation to measure strains;
6. measure and utilize basic properties of materials including elastic modulus and Poisson ratio for isotropic homogeneous materials.
Relationship of course to ME program outcomes

The following measurement standard is used to evaluate the relationship between the course outcomes and the educational-program outcomes:

3 = Strong Emphasis, 2 = Some Emphasis, 1 = Little or No Emphasis.

(a) an ability to apply knowledge of mathematics, science, and engineering—3
(b) an ability to design and conduct experiments, as well as to analyze and interpret data—3
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability—1
(d) an ability to function on multidisciplinary teams—1
(e) an ability to identify, formulate, and solve engineering problems—3
(f) an understanding of professional and ethical responsibility—1
(g) an ability to communicate effectively—2
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context —1
(i) a recognition of the need for and the ability to engage in life-long learning—1
(j) a knowledge of contemporary issues—1
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice—2
(l) application of advanced mathematics—1
(m) design, build, and test in mechanical systems area—1
(n) design, build, and test in thermal/fluids area—1
(o) capstone design experience—1

Contribution to professional component:

90% Engineering Science 10% Engineering Design

Person(s) who prepared this description

Patrick Kwon, Sharon Xiao, and Soonsung Hong

Date of Preparation

5/4/10