EXPANDED COURSE DESCRIPTION
MECHANICAL ENGINEERING
Lassonde School of Engineering
Mechanical Engineering
LE / MECH 2301 3.0 SECTION A
MECHANICS OF MATERIAL 1
FALL 2017 / WINTER 2018

Last Modified Date: 08/23/2017

COURSE CALENDAR DESCRIPTION
This course covers normal and shear stresses and strains in deformable bodies, axial, torsion loading, multi-axis stress analysis, beam bending, analysis of mechanical systems (e.g., pressure vessels, and buckling of columns; design for strength and deflection of a member.) Prerequisites: SC/MATH 1013 3.00, SC/MATH 1014 3.00, and SC/PHYS 1800 3.00.

INSTRUCTOR(S)

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<tr>
<th>Name</th>
<th>Section / Format / Term</th>
<th>Contact Email</th>
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<tr>
<td>Melenka, Garrett</td>
<td>Sec. A / LECT / F</td>
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TOPICS AND CONCEPTS

• Review the principles of statics "General Principles", Mechanics, Basic Concepts, Newton's Laws, Units of Measurements, Accuracy & Approximation, Forces & Equilibrium, Scalars & Vectors, Force, Moment, & Couple, and Mechanical System Isolation (Free Body Diagram)

Week 01-02: Stress
• Equilibrium of a Deformable Body, External Loads, Support Reactions, Equation of Equilibrium, Internal Resultant Loadings, Free Body Diagram (FBD), Normal Stress & Shear Stress, Average Normal Stress, and Average Shear Stress

Week 02: Strain
• Deformation, Strain, Normal Strain, Shear Strain, Cartesian Strain Components, and Small Strain Analysis (Small Deformations)

Week 02-03: Mechanical Properties of Materials
• Tension & Compression Test, The Stress-Strain Diagram, Stress- Strain Behavior of Ductile & Brittle Materials, Hooke's Law, Strain Energy, Poisson's Ratio, and The Shear Stress-Strain Diagram.

Week 03: Axial Load
• Saint-Venant's Principle, Elastic Deformation of Axially Loaded Member, Principle of Superposition, Statically indeterminate Axially Loaded Member, The Force Method of Analysis for Axially Loaded Members, Thermal Stress, and Stress Concentrations

Week 04: Torsion
• Torsional Deformation of a Circular Shaft, The Torsion Formula, Power Transmission, Angle of Twist, Statistically Indeterminate Torque-Loaded Members, and Stress Concentration

Week 05-06: Bending
• Shear and Moment Diagrams, Graphical Method for Constructing Shear and Moment Diagrams, Bending Deformation of a straight Member, The Flexure Formula, Stress Concentrations, and Geometric Properties of an Area (Review)
Week 06-07: Transverse Shear
  • Shear in Straight Members, The Shear Formula, and Shear Stresses in Beams

Week 08: Combined Loadings
  • State of Stress Caused by Combined Loadings

Week 09: Stress Transformation
  • Plane-Stress Transformation, General Equations of Plane-Stress Transformation, Principal Stresses and Maximum In-Plane Shear Stress, and Mohr's Circle (Plane Stress)

Week 10: Design of Beams and Shafts
  • Basis for Beam Design, Prismatic Beam Design, and Shaft Design

Week 11-12: Deformation of Beams, Shafts and Columns
  • The Elastic Curve, Slope & Displacement by Integration, and Method of Superposition. Critical Load, Ideal Column with Pin Support, and Columns Having Various Types of Supports

LIST OF LEARNING OUTCOMES AND EXAMPLES OF

  • Appraise the concepts of stress and strain and analyze the stress-strain diagrams and defines the corresponding material properties and behaviours
  • Draw axial/shear force and bending moments diagrams of 2D parts
  • Determine the internal reactions, stresses and deformation for different loading conditions (axial, bending, torsional, shear, and combined loadings).
  • Determine principal stresses and maximum shearing stress using stress transformation (Mohr circle).
  • Determine deformation and deflection in beams and columns
  • Apply the allowable stress and design for strength principles to design simplified joints, connections and structures

ADDITIONAL INFORMATION

Total scheduled contact hours: 36hr lecture with the instructor and 12hr tutorial with the TA

In-class activities (face-to-face):
  • The course is problem-oriented so students will be involved in hands-on solving of problems throughout the course (tutorials)
  • Opportunities and encouragement to form small groups to discuss problems and course topics in tutorials
  • 1hr/week tutorials with the TA to reinforce their in-class learning
  • Two quizzes (on weeks 4 and 10), a midterm and a final examination to assess students learning

Out-of-class activities:
  • Ten assignments (handed out on week 2-11 and due in 1 week)

Applications of engineering knowledge and sciences will be encouraged through discussion of problems and case studies during tutorials as well as assignments. In addition, student-to-instructor communications will be fostered through emails, online forum, and scheduled office hours.

ACADEMIC INTEGRITY LINKS
  • Senate Policy on Academic Honesty - http://secretariat-policies.info.yorku.ca/policies/academic-honesty-senate-policy-on/
  • Academic Integrity - http://lassonde.yorku.ca/academic-integrity

STUDENT LINKS
  • Student Rights and Responsibilities - http://oscr.students.uit.yorku.ca/student-conduct
  • Religious Observance - https://w2prod.sis.yorku.ca/Apps/WebObjects/cdm.woa/wa/regobs
  • Academic Accommodation for Students with Disabilities - http://secretariat-policies.info.yorku.ca/policies/academic-accommodation-for-students-with-disabilities-policy/
Many courses utilize Moodle, York University's course website system. If your course is using Moodle, click here to access it.

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