Syllabus

Mechanics of Materials III: Beam Bending

Course Overview/Objective

This course explores the analysis and design of beam bending problems.

Prerequisite Knowledge

You will need to have successfully completed my earlier course "Mechanics of Materials I: Fundamentals of Stress and Strain and Axial Loading" in order to be successful in this course.

Course Outline

- **Section 1 – Shear Force and Bending Moment Diagrams**
  - Module 1 – General Analysis Approach
  - Module 2 – Real-world beam bending examples
  - o **Topic 1 – Shear Force Diagrams**
  - Module 3 – Introduction-Shear Force and Bending Moment Diagrams
  - Module 4 – Shear Force Diagrams
  - o **Topic 2 – Bending Moment Diagrams**
  - Module 5 – Bending Moment Diagrams
  - Module 6 – Shear Force and Bending Moment Diagram Examples

- **Section 2 – Elastic Beam Bending**
  - o **Topic 1 – Fundamentals in beam bending**
  - Module 7 – Strain-curvature relationship
  - Module 8 – Locate Neutral Axis/Surface
  - Module 9 – Moment-Curvature relationship
  - Module 10 – Elastic flexural formula
  - Module 11 – Area moment of interia
  - Module 12 – Section modulus
  - o **Topic 2 – Elastic beam bending examples**
  - Module 13 – Solve an elastic beam bending problem
  - Module 14 - Solve an elastic beam bending problem (cont.)
  - Module 15 – Solve an elastic beam bending problem (cont.)

- **Section 3 – Inelastic beam bending**
  - o **Topic 1 – Define inelastic beam bending**
  - Module 16 – Define inelastic bending for symmetric cross sections
  - Module 17 – Define inelastic bending for unsymmetric cross sections
  - o **Topic 2– Inelastic beam bending examples**
  - Module 18 – Solve an inelastic beam bending problem for symmetric cross sections

Module 19 – Solve an inelastic beam bending problem for symmetric cross sections (cont.)

Module 20 – Solve an inelastic beam bending problem for symmetric cross sections (cont.)

Module 21 - Solve an inelastic beam bending problem for unsymmetric cross sections

Module 22 - Solve an inelastic beam bending problem for unsymmetric cross sections (cont.)

- **Section 4 – Shear Stresses in Beams subjected to Non-Uniform Loading**
  - o **Topic 1 – Fundamentals of shear stress in beams**

    Module 23 – Derive expression for shear stress in beams subjected to non-uniform loading

    Module 24 – First moment of outward area
  - o **Topic 2– Examples – Shear stress in beams subjected to non-uniform loading**

    Module 25 – Solve a shear stress problem in a beam subjected to non-uniform loading

    Module 26 – Solve a shear stress problem in a beam subjected to non-uniform loading (cont.)

- **Section 5 – Design of Beams**
  - o **Topic 1 – Fundamentals – Design of Beams**

    Module 27 – Review shear force and bending moment diagrams

    Module 28 – Types of stresses acting on beam cross sections

    Module 29 – Maximum Normal Stress Failure Theory

    Module 30 – Maximum Shear Stress Failure Theory
  - o **Topic 2– Design of Beams**

    Module 31 – Beam design problem

    Module 32 – Beam design problem (cont.)

    Module 33 – Beam design problem (cont.)

    Module 34 – Beam design problem (cont.)

    Module 35 – Course conclusion

Quizzes and Verified Certificates

Each of the five sections of the course has a quiz. To pass each section of the course, you must correctly answer 2 out of the 3 questions on the quiz.

You are allowed 1 attempt to pass each quiz every 7 days.

If you purchased the Certificate option, you are eligible to receive the certificate once you have successfully passed the quiz for all five sections of the course. Please note that purchasing the Certificate is optional.

Course Textbook or Online Resources

While no specific textbook is required, the course is designed to be compatible with any basic mechanics of materials textbook. You will find it useful in learning the material to acquire a basic engineering mechanics of materials textbook to use as a reference and for completing additional practice problems.

Expectations

Participants are expected to:

- Watch all lecture videos. Complete the quizzes.
- Abide by the standards of academic honesty and the Coursera Honor Code – plagiarism or any form of cheating will not be tolerated and will result in the removal of the participant from the course.

Netiquette

Written language will be primary means of communication. As such, there can be miscommunication as there is no intonation in these written communications. Please be positive, supportive and constructive in your comments and forum postings.

System of Units

This course will use both the English (Imperial) system of units and the International System (SI) (metric) system of units.

For students outside of the United States, the English (Imperial) system of units will be unfamiliar and may be a source of frustration. Please view this as a learning process where you will be learning something new.

While there have been efforts to make the metric system the standard for use in the United States, unfortunately those efforts have failed to date. I, personally, would like to see the U.S. adopt the metric standard. But, for my U.S. students, it is imperative that they understand and be able to use the English system of units, as well as the SI system of units. This is why I will use a mixture of both systems in my lectures and examples throughout the course.

Thank you for understanding my choice to use both systems of units in this course.