PHYS 222 Mechanics of Materials 3 credit Hours

An introductory engineering course for Civil, Mechanical, and Aerospace Engineering Programs.

Text: Mechanics of Materials by Beer, Johnston, DeWolf, Mazurek 6th Edition

Professor: John Buschert

Content: A study of stress and strain analysis in engineering materials. Topics will include axial, torsional, bending and shear loads, stress and strain transformations, design and deflection of beams and shafts, buckling and energy methods. Prerequisite: PHYS 220 Engineering Statics or consent of instructor.

Classes will be focused on learning to solve real engineering problems using basic traditional methods as well as computer solutions using MATLAB.

Some class meetings will take advantage of the small class size to include a laboratory demonstrations which will give all students more direct experience with the behavior of materials under stress.

Project: Each student will choose a design project and complete a detailed design using the ideas from this course, previous courses as well as other materials. This could be a very simple bridge or platform or an addition to some structure. The student is to complete the design to as detailed a degree as possible, specifying beam types, materials, sizes and types of bolts etc. Every aspect and choice is to be evaluated and justified with calculations and appropriate safety factors. Students will choose a project after the first test, make an initial presentation after the second and make a final presentation on the last day of class.

**PHYS 222 Mechanics of Materials**

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| Chapter | Section | Problems | Due |
| Ch 1 Stress | * 1. – 1.9 Axial , Shear   1.10 – 1.13 Oblique, Componnents  Review | 1.1, 7, 18, 26  1.30, 33, 36, 37, 39  1.61, 68, 1.C1, C5 | Sept 1  Sept 4  Sept 6 |
| Ch 2 Strain, Axial | 2.1 – 2.8 Stress-Strain  2.9, 2.10 Indeterminate, Temperature  2.11, 12, 14, 15 Poisson, Shear Strain  2.17, 18, 19 St. Venant, Stress Concentration  Review | 2.1, 11, 18, 22, 30  2.35, 41, 45, 51, 55  2.61, 64, 67, 76, 78  2.93, 95, 97, 105, 111  2.129, 130, 2.C3, C6 | Sept 8  Sept 11  Sept 13  Sept 15  Sept 18 |
| Ch 3  Torsion | 3.1 – 3.1 Intro, Elastic Stresses  3.5, 3.6 Twist Angle, Indeterminate  3.7, 3.8 Design, Stress Concentration  Review | 3.2, 5, 8, 24  3.31, 33, 38, 55, 61  3.64, 69, 75, 86, 88  3.151, 155, 3.C2, C6 | Sept 20  Sept 22  Sept 25  Sept 27 |
| Test 1 | Chapters 1 - 3 |  | Sept 29 |
| Projects | Project Idea |  | Oct 2 |
| Ch 4 Bending | 4.1 – 4.5 Stress & Elastic Deformation  4.6, 4.7 Multiple materials, Stress Conc  4.12 – 4.14 Assymetric Cases (2 units)  Review | 4.1, 4, 11, 19, 23  4.34, 38, 42, 49, 64  4.102, 105, 119 / 128, 135  4.194, 199, 4.C1, C5 | Oct 4  Oct 6  Oct 9  Oct 11 |
| Ch 5 Bending Design | 5.1, 5.2 Shear & Bending Moment Diagrams  5.3 Load, Shear, Bending Moment  5.4 Designing Prismatic Beams  Review | 5.5, 9, 16, 19, 30  5.38, 51, 54, 58  5.65, 77, 82, 91  5.153, 159, 5.C3, C4 | Oct 13  Oct 23  Oct 25  Oct 27 |
| Ch 6  Shear in Beams | 6.3 – 6.4 Shear Stresses in Common Beams  6.6, 6.7 Longitudinal Shear, Thin wall case  Review |  | Oct 30  Nov 1  Nov 3 |
| Test 2 | Chapters 3-6 |  | Nov 6 |
| Projects | Project Reporting |  | Nov 8 |
| Ch 7 Transformations | 7.1 – 7.3 Transforming Stress  7.4 Mohr’s Circle  7.5, 7.6 General State, 3-D Mohr  7.9 Stress in Thin Wall  Review | Need to consolidate two of these four into one unit or omit one | Nov 10  Nov 13  Nov 15  Nov 17 |
| Ch 9  Deflection | 9.1 – 9.3, 9.5  9.7, 9.8  Review |  | Nov 20  Nov 22  Nov 27 |
| Ch 10  Columns | 10.1 – 10.4 Stability, Euler’s Formula  10.6, 10.7 Design of Columns  Review |  | Nov 29  Dec 1  Dec 4 |
| Ch 11  Energy Methods | 11.1 – 11.6 Strain Energy  11.7 – 11.10 Impact Loads  Review | Just one problem set | Dec 6 |
| Projects | Project Final Report |  | Dec 8 |
| Final Exam | Chapters 7 – 11 and 1 - 6 |  |  |