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, ComponnentsReview | 1.1, 7, 18, 261.30, 33, 36, 37, 391.61, 68, 1.C1, C5 | Sept 1Sept 4Sept 6 |
| Ch 2 Strain, Axial | 2.1 – 2.8 Stress-Strain2.9, 2.10 Indeterminate, Temperature2.11, 12, 14, 15 Poisson, Shear Strain2.17, 18, 19 St. Venant, Stress ConcentrationReview | 2.1, 11, 18, 22, 302.35, 41, 45, 51, 552.61, 64, 67, 76, 782.93, 95, 97, 105, 1112.129, 130, 2.C3, C6 | Sept 8Sept 11Sept 13Sept 15Sept 18 |
| Ch 3Torsion | 3.1 – 3.1 Intro, Elastic Stresses3.5, 3.6 Twist Angle, Indeterminate3.7, 3.8 Design, Stress ConcentrationReview | 3.2, 5, 8, 243.31, 33, 38, 55, 613.64, 69, 75, 86, 883.151, 155, 3.C2, C6 | Sept 20Sept 22Sept 25Sept 27 |
| Test 1 | Chapters 1 - 3 |  | Sept 29 |
| Projects | Project Idea |  | Oct 2 |
| Ch 4 Bending | 4.1 – 4.5 Stress & Elastic Deformation4.6, 4.7 Multiple materials, Stress Conc4.12 – 4.14 Assymetric Cases (2 units)Review | 4.1, 4, 11, 19, 234.34, 38, 42, 49, 644.102, 105, 119 / 128, 1354.194, 199, 4.C1, C5 | Oct 4Oct 6Oct 9Oct 11 |
| Ch 5 Bending Design | 5.1, 5.2 Shear & Bending Moment Diagrams5.3 Load, Shear, Bending Moment5.4 Designing Prismatic BeamsReview | 5.5, 9, 16, 19, 305.38, 51, 54, 585.65, 77, 82, 915.153, 159, 5.C3, C4 | Oct 13Oct 23Oct 25Oct 27 |
| Ch 6Shear in Beams | 6.3 – 6.4 Shear Stresses in Common Beams6.6, 6.7 Longitudinal Shear, Thin wall caseReview |  | Oct 30Nov 1Nov 3 |
| Test 2  | Chapters 3-6 |  | Nov 6 |
| Projects | Project Reporting |  | Nov 8 |
| Ch 7 Transformations | 7.1 – 7.3 Transforming Stress7.4 Mohr’s Circle7.5, 7.6 General State, 3-D Mohr7.9 Stress in Thin WallReview  | Need to consolidate two of these four into one unit or omit one | Nov 10Nov 13Nov 15Nov 17 |
| Ch 9Deflection | 9.1 – 9.3, 9.59.7, 9.8Review |  | Nov 20Nov 22Nov 27 |
| Ch 10Columns | 10.1 – 10.4 Stability, Euler’s Formula10.6, 10.7 Design of ColumnsReview |  | Nov 29Dec 1Dec 4 |
| Ch 11Energy Methods | 11.1 – 11.6 Strain Energy11.7 – 11.10 Impact LoadsReview | Just one problem set | Dec 6 |
| Projects | Project Final Report |  | Dec 8 |
| Final Exam | Chapters 7 – 11 and 1 - 6 |  |  |