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Received(time)	3:17 PM
Date	3/6/2007

Ohio Articulation Number (OAN)
Course Submission Form
2005-2006

College/University Stark State College of Technology

Course(s) Submitted(Title & Course #) Advanced Strength of Material - MET221 for

Ohio Articulation Number Strength of Material – OET 008

Date 8-22-06 Course two of a two Course OAN mapping.

Name and title of individual submitting on behalf of the college/university

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Credit Hours 2 qtr sem x
Lecture Hours 1
Laboratory Hours 2 (if applicable)
Pre-Requisites(s) Course work (if applicable)
MET 124 – Statics/Strengths of Materials

Placement Score (if applicable)
(Name of test)
(Domain) (Score)

Catalog/Course Description (Includes Course Title and Course #)

Advanced Strength of Material -MET221
The study of torsion, columns, combined stresses, thin-walled pressure vessels, connections (bolted, riveted, and welded), and statically indeterminate beams. Emphasis is placed on learning the fundamentals and applying them to solving problems.

Texts/Outside Readings/Ancillary Materials

Applied Statics and Strengths of Materials, 3rd edition, Spiegel & Limbrunner, 1999, Prentice Hall, ISBN 0137619901

Course Objectives and/or Plan of Work

The objective of this course is to present a number of advanced topics in strength of materials. Specifically, students should be able to:

- Define the fundamental terms involved in properties and behavior of materials;
- Understand and appreciate the importance of the design process including systematic, well-documented, professional-looking solutions;
- Use either US customary of SI units in solutions;
- Solve strength of material problems in areas of in relevant, applied engineering scenarios;
- Appreciate the importance of strength of materials within the field of engineering.

Description of Assessment and/or Evaluation of Student Learning

The course is fully based on problem solving. The students will be assessed in computational skills in algebra, geometry and trigonometry. Modest use of computer will be required.

Interactive method of learning and multiple approaches will be required in the classroom in applying the principles learnt, such as problem-solving in small groups and in class presentations, and hands-on applications through lab experiments/demonstrations.

Master Syllabi and Working Syllabi (if both are used)

Additional Documentation

Stark State College has subsequent courses entitled “Statics/Advanced Strengths of Materials” and “Advanced Strengths of Materials.” The do not appear to directly map to the *individual* Ohio Equivalent courses “Statics” and Strengths of Materials.” The sequence together, however, appears to map to the Ohio Equivalent sequence.

OBR Use	Action
Approved	
Additional Information Requested	
Rejected	
Date	

Course No. MET221
Prerequisite: MET124
Hours: Class 1; Lab 2; Credits 2

ADVANCED STRENGTH OF MATERIALS

STARK STATE COLLEGE OF TECHNOLOGY
MECHANICAL ENGINEERING TECHNOLOGY
COURSE SYLLABUS

COURSE DESCRIPTION:

The study of torsion, columns, combined stresses, thin-walled pressure vessels, connections (bolted, riveted, and welded), and statically indeterminate beams. Emphasis is placed on learning the fundamentals and applying them to solving problems.

COURSE OBJECTIVES:

The objective of this course is to present a number of advanced topics in strength of materials. Specifically, students should be able to:

- Define the fundamental terms involved in properties and behavior of materials;
- Understand and appreciate the importance of the design process including systematic, well-documented, professional-looking solutions;
- Use either US customary of SI units in solutions;
- Solve strength or material problems;
- Appreciate the importance of strength of materials within the field of engineering.

TECHNICAL SKILLS:

Technical skills will be demonstrated by student's ability to design and analyze the components of mechanical and structural systems from strength point of view.

COMPUTER APPLICATIONS AND COMPUTATIONAL SKILLS:

The students will be able to solve the Strength of Materials problems and present the results in the form of tables and graphs, manually using calculators and also with some use of technical computational software; e.g., Excel spreadsheets.

COMMUNICATION SKILLS:

Students will be able to write the solutions to problems on combined stresses in the form of a brief technical report and present it before the class.

TEXTBOOK:

Applied Statics and Strengths of Materials, 3rd edition, Spiegel & Limbrunner, 1999, Prentice Hall, ISBN 0137619901

COURSE OUTLINE:

Unit 1 Review of Stress and Deformation
Unit 2 Torsion
Unit 3 Combined Stresses
Unit 4 Eccentrically Loaded Columns
Unit 5 Riveted and Welded Joints
Unit 6 Thin-Walled Pressure Vessels

Unit 7 Statically Indeterminate Beams

Note: Syllabus is subject to change based on the needs of the class.

Supporting Documents

The following is a detailed cross-reference of how Stark State addresses the essential learning outcomes as listed by in the Ohio TAGS.

NOTE: This document supports two Stark State courses: "Statics" and "Advanced Statics/Strengths of Materials." The two together meet the essential outcomes for OBR classes OET007 and OET008.

Statics – (3 semester hours) OET 007:
Prerequisite: Physics or Alg/trig

Essential Outcomes:

1. Break force vectors into component and combine forces into a resultant.
   - 1.1 The student will demonstrate a thorough working knowledge of vectors including, breaking into components, vector addition/subtraction, vector equations and matrices.
   - 1.2 The class performs a detailed review of the mathematics of statics
   - 1.3 The class stresses vector mechanics and determination of resultant forces.
   - 1.4 The principles of statics are studied in detail including: the effects of forces, units, transmissibility ant the types/occurrences of forces.

2. Compute moment and couples.
   - 2.1 Force systems are examined for a wide variety of applications.
   - 2.2 The student will study singular forces, multiple forces, concurrent forces, moments and couples.
   - 2.3 The study will find resultants to nonconcurrent force systems.
   - 2.4 The student will be introduced to the principle of moments including Varignon's Thereom.

3. Evaluate systems in force and moment static equilibrium.
   - 3.1 The student will demonstrate an understanding of statically loaded members. Force and moment systems will be evaluated and resultants found.
   - 3.2 See section 2 above

4. Determine forces on members in a truss, frame, and pulley.
   - 4.1 The student will apply the static analysis described in sections 2 and 3 to a variety of mechanical devise including trusses, frames, pulleys and wide array of mechanical components.

5. Apply friction laws.
   - 5.1 The class will study basic frictional theory.
   - 5.2 The student will demonstrate an understanding of the angle of friction, normal forces, frictional coefficients, etc.

5.3 The student will apply frictional theory to various applications including wedges, screw-threads, belt friction and others.

6. Determine the centroid of areas.
   6.1 The class will study centroids and centers of gravity theory and applications.
   6.2 The student will find centroids and centroidal axes for singular and composite areas.

7. Determine moments of inertia.
   7.1 The class will study definitions and basic mathematical concepts for moments of inertia.
   7.2 The student will use the transfer formula to develop moments of inertia.
   7.3 The student will find moments of inertia for composite areas in actual engineering applications.
   7.4 The student will calculate the radius of gyration and explain its relevance.
   7.5 The class will study various geometric configurations and show the applicability of the polar moment of inertia.

Optional Outcomes:

1. Analyze forces, unit vectors, components in 3-D.
   1.1 The student will be exposed to process of 3-D force (vector) analysis.

Strength of Materials – (3 semester hours) OET 008

Prerequisite: Static:

Essential Outcomes:

1. Compute the stress, strain and deformation in a member carrying axial tensile or compressive loads.
   1.1 The student will demonstrate an understanding of the basic concepts of stress and strain.
   1.2 The student will compare and contrast the different loading categories including tensile, compressive, torsional and shear.
   1.3 The stress-strain relationship will be discussed with particular to the tension test, the stress-strain diagram, mechanical properties of materials, Hooke's Law and elastic/plastic behavior.
   1.4 Allowable and calculated tensile/compressive stresses are examined.
   1.5 Compressive loading and compressive stresses are studied.

2. Compute direct shear stress.
   2.1 See 1.2 above
   2.2 The relationship between tensile/compressive stress and shear stress is studied including poison's ratio.
   2.3 Allowable and calculated shear stresses are examined.
   2.4 Various configurations loaded in shear are studied.

3. Compute torsional shear stress and deformation.
   - 3.1 See 1.2 above.
   - 3.2 The student will study members in torsion, torsional shear stress and angle of twist.
   - 3.3 The student will study transmission of power by a shaft.
   - 3.4 Various configurations loaded in shear are studied.

4. Compute the stress due to loading in beams.
   - 4.1 The student will study the types of beams and supports and the types of loadings on beams.
   - 4.2 The student will demonstrate a thorough ability to determine beam reactions and develop shear force and bending diagrams. Also developed will be shear diagrams, moment diagrams and sections for maximum moment.
   - 4.3 Tensile and compressive stresses due to bending in beams are covered in detail. The flexure formula in the computation of bending stresses is used.
   - 4.4 Other topics studied include shear stresses in structural members, beam analysis and inelastic bending of beams.

5. Consider stress concentrations in stress analysis.
   - 5.1 Stress concentration factors are studied for tension and shear.
   - 5.2 Stress considerations are studied for thermal effects and for members composed of two or more materials.
   - 5.3 Various geometries are examined with respect to parametric stress concentration effects

6. Compute shear stress in beams.
   - 6.1 See section 2 above.

7. Compute the deflection of beams due to a variety of loading and support.
   - 7.1 See section 4 above.
   - 7.2 The student will perform introductory studies in the design of beams. Topics covered include the design process, the design of steel beams, and the design of timber beams.
   - 7.3 Deflection of beams is studied with particular attention paid to curvature and bending moment.
   - 7.4 Various methods of calculating beam deflections are examined including the formula method, the moment-area method and moment diagram by parts.