1. EM221 Mechanics for Nuclear Engineers

2. Credit Hours (4)/Contact Hours (5)

3. Course Director – Elizabeth Getto

4. Statics & Mechanics of Materials, 5th Ed., by R.C. Hibbeler; Pearson, 9780134382593

5. Specific course information

   a. Statics is the study of forces and moments acting on bodies that are at rest or moving at constant velocity. It forms the foundation for understanding the behavior of solids and fluids. Mechanics of Materials builds on that foundation to develop an understanding of WHY THINGS BREAK and how to design against failure. In Statics we will be studying rigid bodies in equilibrium. Real bodies are not rigid, and consequently they deform when forces and moments are applied. Mechanics of Materials looks at how bodies deform and the internal stresses and strains that develop. Response of a component to those stresses is determined by the properties of the material. Failure theories provide the link between stresses and properties to provide the essential link in design against failure.. All laboratory projects are structured to provide strong physical illustrations for the topics covered in lectures.
   b. Prerequisites: n/a, Co-requisites: SP212 and SM221
   c. Required for Nuclear Engineering Program. EM211+EM217 may be approved as substitute

6. Educational objectives for the course

   a. Apply critical thinking to raise and formulate vital questions about a problem, gather and assess relevant information, come to well-reasoned solutions and conclusions, and test them against relevant criteria and standards.

   b. Construct free-body diagrams and to select suitable coordinate axes.

   c. Formulate static equilibrium equations for bars, shafts, beams, trusses, and frames to determine reaction forces/moments

   d. Formulate static equilibrium equations for bars, shafts, beams, trusses, and frames to determine internal forces/moments.

   e. Determine centers of gravity and moments of inertia of simple and composite geometric regions.

   f. Calculate how applied forces and temperature changes affect the shape of deformable bodies.

   g. Predict stresses in structural elements undergoing axial loads, torsional loads, bending loads in a combined loading state.

   h. Write complete and accurate technical reports that describe the experiments conducted, analyze results, and report appropriate conclusions.

7. Specific program outcomes addressed by this course

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Reinforced	X		X			X	

8. Brief list of topics to be covered

a. Scaler and Vector Operations, 2 D & 3D
b. Moments, Cross Products and Couples
c. Free Body Diagrams
d. Newton's First Law in 2D/3D
e. Equilibrium 2D/3D
f. Trusses, Method of Joint
g. Frames
h. Internal Forces and Moments
i. Axial stress, Shear stress
j. Factor of safety, Allorable stress
k. Deformation and Strain
l. Mechanical Properties and the Stress Strain Curve
m. Axial Deformation
n. Statically Indeterminate Axial Deformation
o. Thermal Stress, Statically Indeterminate Axial Deformation
p. Torsional Stress, Statically indeterminate torsion
q. Section properties: Centroids, Parallel Axis Theorem, Moments of Area of Inertia
r. Shear and Bending Moment Diagrams
s. Bending Stress in Beams
t. Transverse Shear
u. Combined loading
v. Stress Transformations and Principal Stresses
w. Mohr's Circle
x. Generalized Hooke's Law
y. Thin Walled Pressure Vessels
z. Failure Theories Ductile Materials