MECH3020 Mechanics of Solids II

Course Code: MECH3020	**Course Title:** Mechanics of Solids II
Required Course Or Elective Course: elective	**Terms Offered (Credits):** Fall or Spring (3 credits)
Faculty In Charge: Hong Tao	**Pre/Co-Requisites:** MECH3010

Course Structure:

2 lectures/week plus one tutorial/week

Textbook/Required Material:

<<Mechanics of Materials>> by Beer, Johnston, Dewolf, and Mazurek

Course Description:

The course teaches the students the basic theory and concepts of 2D stress analysis for structure elements and enable the students to perform the practical 2D stress analysis and get quantitative solutions through the assigned homework exercises. The skills will be quantified and assessed in assignments, midterm and final examination.

Course Topics:

1. Review on axial loading, torsion, and pure bending
2. Stress transformation and failure
    a. Non-linear material behaviors
    b. Stress concentration at a circular hole in an infinite plate
    c. 3 dimensional stress transformations and Mohr's circle
    d. Failure theories
3. Torsion of noncircular bar and hollow shafts
    a. Plastic deformation in circular shafts
    b. Differential equation of motion of a deformable body
    c. Small displacement theory
    d. Torsion of noncircular members
    e. Torsion of thin-walled hollow shafts
4. Eccentric loading and Un-symmetric bending
    a. Bending of composite member
    b. Plastic deformation in bending
    c. Un-symmetric bending
    d. General eccentric loading
    e. Bending of curved members
5. Design of beams in bending
    a. Load, shear, bending moment relationships in bending of non- /prismatic beams
    b. Expressing load, shear, bending moments with singularity functions
    c. Bending of beams on elastic foundations
6. Shearing stress in beams & thin-walled members
    a. Shear flow
    b. Shearing stress in composite beams
    c. Shear center and un-symmetric loading of thin-walled members
7. Deflection of beams
    a. Deformation of a beam under transverse loading
    b. Statically indeterminate beams
    c. Method of superposition
8. Bending of plate (extension of beam bending)

9. Energy methods a. Strain energy expression b. Work and energy under single and multiple loads c. Castigliano's theorem on deflection	
Course Objectives:	1. To give the students a conceptual framework on how to perform practical 2D stress analysis for most common engineering structure members and components. 2. To impart to the students the basic methodology and tools necessary for a 2D mechanics stress analysis. 3. To develop the students' analytical ability necessary to conduct the structure safety assessment. 4. To develop the capabilities of the quantification to conduct engineering design in the future.
Course Outcomes:	A. Demonstrate a comprehensive understanding of the deformation of structure members under external mechanical loading. B. Demonstrate the ability to quantify the deformation and the internal stress and internal force. C. Demonstrate analytical capability. D. Demonstrate the mechanical design capability.
Assessment Tools:	Assignments 30% Mid-term 30% Final exams 40%