1. Course Number and Name: **MER311 – Advanced Mechanics**
2. Credits and contact hours: 1 Union Course Credit. Standard lecture slot (either 3 times weekly for 65 minutes or twice weekly for 105 minutes)
3. Course Coordinator: Professor William Keat
4. Text: Beer, F.P. et al, *Mechanics of Materials, 6th Edition,* New York, NY: McGraw- Hill, 2012, with additional notes on fatigue
5. Specific course information:
6. Catalogue description: Advanced topics in stress analysis, deflection and stiffness, energy methods, failure analysis, fracture mechanics, statistical considerations, impact, fatigue, introduction to finite element methods.
7. Prerequisites and co-requisites: Prerequisite: MER214.
8. Required Course
9. Specific goals for this course:
10. Specific outcomes of instruction:
11. Through the lectures, learn advanced topics in stress analysis including deflection and stiffness, energy methods, failure analysis, fracture mechanics, impact, fatigue
12. Learn how to analyze complex structures accurately using a combination of analytical and finite element methods.
13. Gain experience applying the analytical and finite element methods to design of structures.
14. Criterion 3 and other outcomes addressed:
15. an ability to apply knowledge of mathematics, science, and engineering
16. an ability to design a system, component, or process to meet desired needs within realistic constraints, such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
17. an ability to identify, formulate, and solve engineering problems
18. a recognition of the need for, and an ability to engage in life-long learning
19. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
20. Brief list of topics to be covered:
21. General 3D State of Stress – generalized Hooke’s Law, 2D and 3D Mohr’s circle, principal stresses as eigenvalues
22. Static Failure Theories – ductile and brittle failure theories
23. Fatigue Failure of Metals
24. Beams – elastic-plastic behavior, composite beams, curved beams, deflections by integration, deflections by superposition with the beam tables, unsymmetric bending
25. Buckling – elastic buckling, inelastic buckling
26. Torsion – plastic torsion, non-circular members, thin-walled members
27. Finite Element Method
28. Energy methods – strain energy, estimation of impact force, Castigliano’s Theorems
29. Introduction to Fracture Mechanics