The Hashemite University
Faculty of Engineering
Course Syllabus

Course Title:	Strength of Materials	**Course Number:**	110402212
Department:	Mechanical Engineering	**Designation:**	Compulsory
Prerequisite(s):	110401211		
Instructor:	Eng. Ahmad Bani yaseen	**Instructor's Office:**	E3102
Instructor's e-mail:	ahmadi_ah@hu.edu.jo		
Office Hours:	by appointment		

Course description: The Machine Types of loads, structures and supports, axial stress and strain, normal and bending moment diagrams, torsion, bending of beams, combined stresses, shearing stress and strain, Mohr's circle of stress and strain, thin walled pressure vessels, deflection of simple beams, buckling of columns.

Textbook(s): Mechanics of Materials, F. P. Beer et al, Eighth edition, Mc Graw Hill.

Course Outcomes: After completing the Strength of Material course, the student will:

- Recognize the different types of loading and their effects on the mechanical systems (axial loading, transverse loading, bending moments, torsion torques).
- Know the definitions of normal stress, normal strain, shear stress, shear strain,…etc.
- Analyze the stress and strain in order to design mechanical system that can withstand a given set of loading.
- Recognize the different types of deformations and study their relations to stress and strain.
- Be able to analyze statically determinate and statically indeterminate structures under different types of loading (axial loading, torsional torque and transverse loading).
- Construct shear and bending moment diagrams for beams and analyze the resulted stresses.
- Be familiar with the stress transformations and Mohr's circle and find the principal stresses and the maximum shear stress.
- Relate the beam deflection to the internal moment and derive the elastic curve of the beam.

Class schedule: Three class sessions each week; 50 minutes each

Grading Plan:

Midterm Exam	(30 Points)
Assignments & Quizzes	(20 Points)
Final exam	(50 Points)

Course designation according to the professional component:

Professional Component	Course Designation
General Education	-----
Basic Science and Mathematics	----
Engineering Science	√
Engineering Design	√

Course relationship to program outcomes:

	ME Program Outcomes
√	1. Apply knowledge of science, mathematics (including multivariate calculus, linear algebra, differential equations) and engineering fundamentals to mechanical engineering applications. **(a, ME1)**
	2. Design and conduct experiments, as well as analyze and present results in a professional manner. **(b)**
√	3. Design, model, analyze and realize a component, system (thermal or mechanical), or process to meet specific requirements and realistic constraints. **(c, ME2)**
	4. Communicate effectively, and function in multidisciplinary teams. **(d, g)**
√	5. Identify, formulate, and solve engineering problems. **(e)**
√	6. Understand professional and ethical issues and the responsibilities of the engineering practice. **(f)**
√	7. Recognize contemporary issues and environmental, cultural, and economical consideration of the engineering profession. **(j, h)**
	8. Identify the need for professional development and engage in life-long learning. **(i)**
	9. Use the techniques, skills, and modern engineering and computing tools necessary for engineering practice. **(k)**
√	10. Apply the basics of statistics and probability. **(ME3)**
	11. Recognize the need and engage in solving national environmental issues.

Course relationship to ABET criteria for mechanical engineering programs:

	Programs must demonstrate that graduates have:
√	A. Knowledge of chemistry and calculus-based physics with depth in at least one;
	B. The ability to apply advanced mathematics through multivariate calculus and differential equations;
√	C. Familiarity with statistics and linear algebra;
√	D. The ability to work professionally in both thermal and mechanical systems areas including the design and realization of such systems.

Prepared by: Eng. Ahmad Bani yaseen **Date:** 11/Oct/2020

Course Contents and Approximate time line

Chapter	**1**	**Introduction - Concept of Stress**	
	1.1	Introduction	
	1.2	A short review of the method of statics	**1**
	1.3	Stress in the members of a structure	
	1.4	Analysis and design	
	1.5	Axial loading, Normal stress	
	1.6	Shearing stress	**2**
	1.7	Bearing stress in connections	
	1.8	Application to the analysis and design of simple structures	
	1.11	Stress on an oblique plane under axial loading	
	1.12	Stress under general loading conditions; components of stress	**1**
	1.13	Design consideration	
Chapter	**2**	**Stress and strain – axial loading**	
	2.1	Introduction	
	2.2	Normal strain under axial loading	**1**
	2.3	Stress-strain diagram	
	2.5	hook's law (modulus of elasticity)	
	2.6	Elastic versus plastic behaviour of a material	
	2.7	Repeated loading (fatigue)	**2**
	2.8	Deformation of members under axial loading	
	2.9	Statically indeterminate problems	**2**
	2.10	Problems involving temperature changes	
	2.11	Poisson's ratio	**2**
	2.12	Axial loading- (generalized hook's law)	
	2.14	Shearing strain	
	2.15	Relationship among *v*, E and G	**2**
	2.17	Stress and strain distribution under axial loading	
	2.18	Stress concentration	
Chapter	**3**	**Torsion**	
	3.1	Introduction	
	3.2	Preliminary discussion of the stresses in a shaft	**2**
	3.3	Deformation in a circular shaft	
	3.4	Stresses in the elastic range	
	3.5	Angle of twist in the elastic range	**3**
	3.6	Statically indeterminate shafts	
	3.7	Design of transmission shafts	**1**
	3.8	Stress concentration in circular shafts	
Chapter	**4**	**Pure bending**	
	4.1	Introduction	
	4.2	Symmetric member in pure bending	**2**
	4.3	Deformation in a symmetric member in pure bending	
	4.4	Stresses and deformations in the elastic range	
	4.5	Deformations in a transverse cross-section	**2**
	4.6	Bending of members made of several materials	
Chapter	**5**	**Analysis and design of beams for bending**	
	5.1	Introduction	**2**
	5.2	Shear and bending moment diagrams	
	5.3	Relations among load, shear and bending moment	

Chapter	**6**	**Shearing stresses in beams and thin-walled members**	
	6.1	Introduction	**2**
	6.2	Shear on the horizontal face of a beam element	
	6.3	Determination of the shearing stresses in a beam	
Chapter	**7**	**Transformations of stress and strain**	
	7.1	Introduction	**2**
	7.2	Transformation of plane stress	
	7.3	Principal stresses : Maximum shearing stress	
	7.4	Mohr's circle for plane stress	**2**
	7.5	Generalized state of stress	**1**
	7.9	Stresses in thin-walled pressure vessels	
Chapter	**8**	**Principal stresses under a given loading**	**2**
	8.4	Stresses under combined loading	
Chapter	**9**	**Deflection of beams**	
	9.1	Introduction	**1**
	9.2	Deformation of a beam under transverse loading	
	9.3	Equation of the elastic curve	
Chapter	**10**	**Columns**	
	10.1	Introduction	**1**
	10.2	Stability of Structures	
	10.3	Euler's formula for pin-Ended columns	
	10.4	Extension of Euler's Formula to Columns with Other End Conditions	