Università degli Studi della Basilicata
Scuola di Ingegneria

COURSE: Machine Design I			
TEACHER: Katia Genovese			
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LANGUAGE	Italian		
ECTS: 6	ACADEMIC YEAR: 2014-2015	Campus: Potenza	Semester: 2°

TOPICS

Objective of the course of Machine Design I is to provide undergraduates with the basic concepts on the mechanical behaviour of materials with special attention to the application of design methodologies for mechanical components and systems on the basis of loads, constraints and operation conditions.

TEACHING METHODS

Lectures and laboratories

TEXTBOOKS

Course notes.

Reference books:
R. Giovannozzi, *Costruzione di Macchine*, Voll.1-2, Patron editore, Bologna.
F.P. Beer, E.R. Johnston, J.T. DeWolf, *Meccanica dei solidi: elementi di Scienza delle Costruzioni,* McGraw-Hill, Milano, 2002.
L. Vergani, *Meccanica dei materiali,* McGraw-Hill, Milano, 2001.
R.C. Juvinall, K. M. Marshek, *Fondamenti della progettazione dei componenti delle macchine,* Edizioni ETS, Pisa, 2001.
A. Bernasconi, M. Filippini, M. Giglio, A. Lo Conte, G. Petrone, M. Sangirardi, *Fondamenti di costruzioni di macchine*, McGraw-Hill, Milano, 2002.

LEARNING OUTCOMES

To acquire a basic knowledge on the issues related to the mechanical design with special regards to the application of the basic engineering methodologies to design mechanical components and bolted and welded joints for static, fatigue and fracture strenght.

REQUIREMENTS

Strenght of materials

EVALUATION METHODS

Design Project
Written and Oral Final Exams

DETAILED CONTENT

Fundamentals of Machine Design.
Mechanical design stages and methodologies. Definition of failure: static and fatigue strenght. Safety factors, tollerances, standards. Mechanical design approaches: safe-life, fail-safe, damage-tolerant.

Elasticity theory. Strain and stress states in beams.
Review of the basic principles of Elasticity. Kinematics. Internal forces and moments in statically determinate problems. Geometric properties (centroids, moments of inertia, etc.) of structural elements. Axial, bending, shear and torsion loads. Free body diagram. Strain and stress state. Mohr's circle. Combined loading. Principal stresses. Failure criteria. Material constitutive laws. Application of strengh of materials equations and formulas to the solution of engineering and design problems. Plastic deformation and yield criteria. Strain gauges.

Strenght of materials and mechanical components.
Principle of engineering material testing: definition of strenght, hardness, ductility, toughness. Fracture. Ductile and brittle failure. Notch effect. Residual stress.

Fatigue of mechanical components.
Fatigue strenght of mechanical parts with no flaws. Constant amplitude fatigue. Whöler's curve. Parameters that affect the fatigue-life. Notches and stress concentrations. Haigh's diagram. Variable amplitude fatigue. Miner's Formula. Multiaxial fatigue: Gough-Pollard's approach. Fatigue in welded joints.

Fracture mechanics.
Linear Elastic Fracture Mechanics (LEFM). Modes of loading. Irwin's theory and formulation. Stress intensity factor K_{IC}. Fracture toughness testing. Parameters that affect K_{IC}. Shape factors. Validity of LEFM. Fatigue strenght of mechanical parts with flaws. Paris law.

Mechanical components design.
Power transmission shafts. Bolted joints. Welded joints.

FURTHER INFORMATION