Department of Mathematics

Course Profile

Course Number: MATH 352	**Course Title: Mathematical Theory of Elasticity**
Required / Elective: Required	**Prerequisites:** none
Catalog Description: Analysis of strain and stresses, linear constitutive relations, field equations of linear elastic bodies, basic equations of elastostatics, existence and uniueness theorems. Plane elasticity; plane strain and stresss case; compatibi,lity conditions. Airy stress function, solution in cartesian and polar coordinates. Elastic waves, reflection and refreaction of elastic waves.	**Textbook / Required Material:** Elasticity, Robert Wm Little, Prentice Hall, 1972.
Course Structure / Schedule: (3+2+0) 3 / 6 ECTS	
Extended Description: Vectors and tensors; Summation convention; first order tensors, second order tensors; Symmetric and skew-symmetric tensors. Transformation of tensors;Invariant of tensors;Kronecker delta, permutation symbols, Dot and cross product of vectors; Divergence and rotation of vectors; Divergence of second order tensors. Kinematics of continuous bodies: Spatial and material coordinates;Material time derivative; Velocity and acceleration vectors. Displacement vector; Infinitesimal strain tensors; Compatibility conditions. Stress: The concept of internal forces and stress vector; Surface traction; The concept of stress tensor. Properties of stress tensor; Normal and shear stresses; Solution of some problems. Balance equations of continuous bodies: Conservation of mass; Balance of linear and angular momenta.Stress quadratic of Cauchy; Principal directions and principal values of the stress. Conservation of energy. The concept of internal energy. The field equations of isotropic elastic materials; Initial and boundary conditions; Stress and displacement formulations. General theory of plane elasticity; plane deformation; Plane stress; Airy stress function. Plane elasticity problems in Cartesian and polar coordinates. Reflection and Diffraction of elastic waves.	
Design content: None	**Computer usage:** No particular computer usage required

Course Outcomes: By the end of the course the students should be able to:

1. construct a mathematical modelling for engineering materials **[2],**
2. understand the physical characterization of various differential equations encountered in written literature **[2,6],**
3. solve some practical problems by use of the mathematics he(she) learnt throughout his(her) education **[3,6].**

[2] demonstrate knowledge of mathematics and mechanics to construct, analyze and interpret real world problems,
[3] demonstrate the ability to apply mathematics to the solutions of problems,

[6] have a basic knowledge of the main fields of mathematics and mechanics, including differential equations, elasticity theory, fluid mechanics,

Recommended reading: Any book on elasticity theory
Teaching methods: Three hours theoretical presentation with illustrative problem solving, and homework per week.
Assessment methods: Homework,, midterm and final exams.
Student workload: Pre-reading ....15 hrs Lectures ………………………………………45 hrs Tutorials ………………………………………30 hrs Preparatory reading ………………….….. 25 hrs Literature review for presentation………… 25 hrs Team work for presentation ………………10 hrs **TOTAL ……………………………… 150 hrs …… to match 25x6 ECTS**

Prepared by: Prof. Dr. Hilmi Demiray	Revision Date: 08.02.2010