

**Department:** Mining Engineering

**Division:** Rock Mechanics

**Level and Major:** MSc, Rock Mechanics

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**Course Title:** Principles of Design and Analysis of Underground Openings

**Number of Credits:** 3

**Lecturer:** Dr. Hossein Salarirad

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### **Course Goals and Objectives**

Introducing students to the principles of solid mechanics and solving practical problems in rock mechanics.

### **Course Topics**

- Stress definition and relationships in isotropic and non-isotropic three-dimensional elastic media, convention, and definitions
- State of stress, Stress tensor and deviatoric stress tensor, Projection of stress components on a surface
- Stress balance equations, principal stresses, Invariant stress tensor, and Mohr's circle
- Maximum shear stresses and octahedral stresses
- Deformation in Lagrangian and Eulerian coordinates
- Strain and displacement definition, conventions, Linear and nonlinear relationships and tensors, Strain-Displacement compatibility equations
- Stress-strain relationships in non-isotropic and isotropic elastic environments, elastic strain energy
- Linear elasticity and generalized hook law
- Linear elastic relationships in Anisotropic and Isotropic materials
- Problems solution of Rock Mechanics based on the linear elasticity
- Solving 1-D and 2-D problems, plane strain, plate stress
- Elasticity equations based on displacement components, Navier equations, and stress, Beltrami-Michel equations
- Stress functions, Airy stress functions, Problem-solving in geomechanics using Airy stress functions
- Perfect elastic-plastic behavior of solids, typical stress-strain curve of a homogeneous isotropic material under tension in isotherm conditions
- Tresca, Von Mises, Mohr-Coulomb and Draker-Prager Criteria, Yield surface function and Floe rule
- The solution of some applied problems in rock mechanics based on the nonlinear plastic criteria