Approved in 45th BoA Meeting (18-02-22)

Course number : CE514
Course Name **:** Rock Mechanics
Credit Distribution **:** 3-0-0-3
Intended for **:** UG elective and PG elective
Prerequisite **:** Geotechnical Engineering (CE 302) or Equivalent
Mutual Exclusion **:** None

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1. Preamble:

India is rapidly marching towards modern and sustainable infrastructure. Most of the signature projects are being developed in hilly regions which include bridges (e.g., Chenab Bridge), tunnels (e.g., Rohtang Atal Tunnel), dams, buildings, etc. All these structures are either founded on rocks or are constructed in rocks. In view of this, it has become necessary to include a dedicated course on rock mechanics in the civil engineering curriculum. Therefore, a course on 'Rock Mechanics' is being proposed with the following objectives: (i) to understand the engineering behaviour and properties of rocks, (ii) to broaden the view-point of geotechnical/structural engineering students who have already done a course on soil mechanics, (iii) to explain the challenges faced by geotechnical as well as structural engineers while designing/constructing structures in or on rocks, and (iv) to get the benefit of special location of IIT Mandi campus and initiate the process of developing IIT Mandi as a rock mechanics centre of excellence in future.

2. Course Modules with quantitative lecture hours:

Module 1: Introduction to rock engineering, basics of geology for rock engineers, engineering and index properties of intact rocks, demonstration of laboratory techniques, design implication of different properties of intact rocks. **[5 hours]**

Module 2: Discontinuities in rocks, engineering behaviour and characterization of discontinuities, types and description of discontinuities, orientation and spacing, discontinuity modelling, roughness, aperture, joint stiffness, RQD estimation. [**5 hours]**

Module 3: Various geological features of rock-mass and their application in rock-mass classification (RMR, RMi, Q, GSI), correlation between different rock-mass classifications, weathering of rock-mass and its classification. **[5 hours]**

Module 4: Deformability characteristics of jointed rock-mass, different types of moduli, challenges/issues with in-situ deformability measurement, design implications, anisotropy in rock-mass deformability, scale-effect, empirical methods, and equivalent continuum approach. **[8 hours]**

Module 5: Shear strength characteristics of jointed rock-mass, different rock failure criteria and strength models, anisotropy in strength, scale-effect, empirical methods, equivalent continuum approach. **[8 hours]**

Module 6: In-situ stresses in rock-mass and their importance in design of underground caverns and tunnels, permeability of rock-mass. **[3 hours]**

Module 7: Application of rock mechanics to key rock engineering problems such as rock slope failure and stability analysis, foundations on rocks, and application of rock-mass classification in preliminary tunnel support system design. **[8 hours]**

3. Text book:

- Aydan, Ömer. Rock Mechanics and Rock Engineering: Volume 1: Fundamentals of Rock Mechanics. CRC Press, 2019.
- Bieniawski, Zdzislaw T. Design methodology in rock engineering. CRC Press, 2020.

4. References:

- Jaeger, John Conrad, Neville GW Cook, and Robert Zimmerman. Fundamentals of rock mechanics. John Wiley & Sons, 2009.
- Sivakugan, Nagaratnam, Sanjay Kumar Shukla, and Braja M. Das. Rock mechanics: an introduction. CRC Press, 2013.
- Goodman, Richard E. Introduction to rock mechanics. Vol. 2. New York: Wiley, 1989.
- Hudson, John A., and John P. Harrison. Engineering rock mechanics: an introduction to the principles. Elsevier, 2000.
- Ramamurthy, T., ed. Engineering in rocks for slopes, foundations, and tunnels. PHI Learning Pvt. Ltd., 2010.
- Pariseau, William G. Design analysis in rock mechanics. CRC Press, 2006.
- Zhang, Lianyang. Engineering properties of rocks. Butterworth-Heinemann, 2016

5. Similarity with the existing courses:

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.		Course Code	Similarity Content	Approx. % of Content
1.				

6. Justification of new course proposal if cumulative similarity content is >30%: