

**B.E. Semester: VII**  
**Department of Civil Engineering**

**Subject Name: Rock Mechanics (CV803-N-C)**

**Course Category: Program Course Elective – IV (PCE)**

**A. Objectives of the Course:**

- To understand of the mechanical behaviour of rock materials, rock discontinuities and rock masses.
- To be able to analyse and to determine mechanical and engineering properties of rocks for engineering applications.
- To provide basic knowledge of stress concentration fields, rock strength, its associated problems & remedies which will make them able to supervise & drive safe & stable underground opening.
- Identify the type of the rock
- Analyse the rock quality designation and also evaluate its strength
- Determine the methods of tunnelling and mining

**B. Teaching & Evaluation Scheme:**

Teaching Scheme				Credit	Evaluation Scheme					Total Marks
L	T	P	Total		Theory		IE	CIA	Pra/Viva	
hrs	hrs	hrs	Hrs		Hrs	Marks	Marks	Marks	Marks	
2	2	0	4	4	3	70	30	20	30	150

**C. Detailed Syllabus:**

**1. Introduction to Rock Mechanics:**

Definition, Application of Rock Mechanics

**2. Stress and Strain in Rock:**

Analysis of stress, strain and constitutive relations in isotropic and anisotropic rock under static and dynamic loading

**3. Physico - mechanical Properties of Rock:**

Determination of physical properties, Strengths, Strength indices and static elastic constants, Parameters influencing strength, Abrasivity and of its determination, Specific gravity, Hardness, Porosity moisture content, Permeability, Swell index, Slake durability, Thermal conductivity.

**4. Time Dependent Properties of Rock:**

Creep deformation and strength behavior, Creep test and archeological models

**5. Behavior of Rock mass:**

Rock mass structure, Classification in- situ elastic properties and strength determination

**6. Failure Criteria for Rock and Rock mass:**

Mechanics of rock failure, Coulomb, Mohr and Griffith criteria, Empirical criteria

**7. Ground Water**

Influence of water on rock and soil behavior, Permeability of rocks, Measurement of permeability, Ground water flow in rock mass, Measurement of water pressure.

**D. Lesson Planning:**

Unit No	Title of the Unit	Minimum Hours	Weightage (%)
1	Introduction to Rock Mechanics	01	02
2	Stress and Strain in Rock	05	17
3	Physico - mechanical Properties of Rock	05	17
4	Time Dependent Properties of Rock	05	17
5	Behaviour of Rock mass	05	17
6	Failure Criteria for Rock and Rock mass	05	17
7	Ground Water	04	13
Total		30	100

**E. Assignments:**

- To study Physico - mechanical Properties of Rock
- To study Dynamic Properties of Rock and Rock mass
- To study Failure Criteria for Rock
- To study different case studies related to influence of groundwater on rock

## **F. Instructional Method and Pedagogy (Continuous Internal Assessment Scheme CIA):**

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lecture may be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures, practical and Tutorial which carries 05 Marks.
- At regular intervals assignments is given. In all, a student should submit all assignments of 05 marks each.
- Classroom participation and involvement in solving the problems in Tutorial rooms carries 05 Marks.
- One internal exam of 30 marks is conducted as a part of Mid Semester evaluation.

## **G. Students Learning Outcomes:**

On the successful completion of this course

- Resolve problems related to strata stability for safe underground and surface mining operations using knowledge and skills of rock mechanics.
- Identify the type of rock and to evaluate the bearing capacity of the rock.
- Design methodologies for mining and tunnelling where rock is encountered
- Ability to apply mathematics, science and engineering principles.
- Ability to design and conduct experiments, analyze and interpret data.
- Ability to identify, formulate and solve engineering problems.
- Ability to use the techniques, skills and modern engineering tools necessary for engineering practice.

## **H. Recommended Study Materials:**

### **a. Text book & Reference Books:**

1. Rock Mechanics, B. P. Verma.
2. The elements of Mechanics of Mining Ground (Vol I & II), Dr. B. S. Verma.
3. Design Criteria for drill rigs equipments of drilling techniques, C. P. Chugh.

4. Ground Control in Mining, S. K. Sarkar. Goodman R E “Introduction to Rock Mechanics”, John Wiley & Sons, New York, 1989
5. Principles of Engineering Geology and Geotechniques – Krynine and Judd
6. Rock Engineering – Jhon A Franklin and Maurice b Dusseault, McGraw Hill
7. Rock mechanics for Engineers: Varma, B.P, Khanna Publishers
8. Rock mechanics & Design of structures: Obert, L & Duvall, W.I., John Wiley & Sons
9. Jaguer J C and Cook N G W “Foundational of Rock Mechanics” 3rd ed., Chapman & Hall London, 1979
10. Lama R D and Vutukuri V S with Saluja S S “Handbook on Mechanical Properties of Rocks” Vols. I to IV, Trans Tech Publications, Rockport, MA.
11. Arora D S “A Text Book of Geology”, Mahindra Capital Publishers, Chandigarh, 1988
12. Singh P “Engineering and General Geology” S. K. Kataria and Sons, New Delhi, 1992

**b. Web Materials:**

1. [https://en.wikipedia.org/wiki/Rock\\_mechanics](https://en.wikipedia.org/wiki/Rock_mechanics)
2. <http://home.iitk.ac.in/sarv/New%20Folder/Presentation-1.pdf>
3. <https://www.britannica.com/science/rock-mechanics>
4. <https://www.slideshare.net/1971995/rock-mechanics>
5. Nptel.ac.in

**c. Indian Codes of Practice:**

1. IS 7746 1991 Code of practice for in-situ shear test on rock
2. IS 9179 1979 Method for the preparation of rock specimen for laboratory testing
3. IS 11358 1987 Glossary of terms and symbols relating to rock mechanics
4. IS 12070 1987 Code of Practice for Design and Construction of Shallow Foundations on Rocks

