GUJARAT TECHNOLOGICAL UNIVERSITY

BRANCH NAME: GEOTECH ENGINEERING
SUBJECT NAME: ENGINEERING ROCK MECHANICS
SUBJECT CODE:3714309
M.E. Semester-I

Type of course: Program Elective - I

Prerequisite: Knowledge of Geotechnical Engineering

Rationale: The subject is introduced in the first semester as a program elective with a view that student can identify and explore various rock types similar to soil type based on formation, can understand rock classification systems based on rock geology and mechanical properties computed using various field and laboratory tests. Further exploring rock deformation characteristics using various rock failure theories and its application in rock mining (rock openings), rock tunnelling, rock stability and rock foundations.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE(E)	PA (M)	ESE (V)	PA(I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Rock formation:** Rock formation and its genesis, rock and rock mass classification, physical and mechanical properties, defects in rock mass, Elastic constants of rock; Insitu stresses in rock.	07	18
2	**Rock exploration:** Objective of **r**ock exploration, methods of rock exploration; by direct penetration, by geophysical processing, in-situ and laboratory tests.	05	10
3	**Strength Behaviour:** Compression, Tension and Shear, Stress-Strain relationships, Rheological behavior.	06	15
4	**Strength and Failure of rocks:** Theories of rock failure; Mohr-Coulomb, Griffith theory, Hoek and Brown, strength and other strength criteria, discontinuities of rock masses, **e**ffect of discontinuities on strength of rock, Absolute stress measurement in Rocks, single opening in massive elastic rock - Design criteria and stress distribution in various shapes of openings.	16	40

5	**Application of rock mechanics:** Rock tunneling, rock slope stability, bolting, blasting, grouting and rock foundation design. Modern modelling techniques & analyses in rocks.	08	17

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
16	14	12	10	10	08

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Jaeger, J.C & Cook, N.G.W, Fundamentals of Rock Mechanics, Chapman and Hall, 1976
2. Wyllie, D.C; Foundations on Rock, E & FN Spon.2nd Edition, 1992.
3. Goodman, R.E, Introduction to Rock Mechanics, John Wiley & Sons.
4. Hudson J.A & J.P. Harrison, Engineering Rock Mechanics: An Introduction to the Principles, 1997, Elsevier, Oxford
5. Singh B and Goek R.K., Rock Mass Classification-A Practical Engineering Approach, Elsevier
6. Hoek.E, 'Practical Rock Engineering', Rock Science.

Course Outcome:

After learning the course the students should be able to:

1. Understand rock formation and various rock classification systems
2. Rock exploration based on geophysical methods
3. Determine mechanical properties of rock and rock testing
4. Application of rock failure theories to determine deformation characteristics
5. Design rock openings and related parameters
6. Design rock foundation, rock bolting and rock tunnelling.

List of Experiments:

1. Physical properties of rock
2. UCS with E and μ
3. Brazilian test
4. Slake durability index test
5. Direct Shear test
6. Triaxial compression test

7. Schmidt Hammer test
8. Ring Shear test
9. Ultrasonic pulse velocity test

Major Equipment:

1. Rock triaxial machine,
2. Rock compression machine,
3. Large size box shear apparatus,
4. Ultrasonic pulse velocity tester

List of Open Source Software/learning website:

- http://nptel.ac.in/
- http://ocw.mit.edu/courses/civil-and-environmental-engineering/

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