

Course Type	Course Code	Name of Course	L	T	P	Credit
DE	NGLD404	Kinematics of Rock Deformation	3	0	0	3

Course Objective
The primary objective of the course is to provide theoretical background for an in-depth understanding of deformation processes in rocks.
Learning Outcomes
Upon successful completion of this course, students will: <ul style="list-style-type: none"> • Develop confidence in identifying, describing and analyzing a deformation structure in rocks. • Have a detailed idea of strain processes in rocks • Understand how geometry of deformation structures are related to material point movement within a deformed body • Be able to apply the knowledge in Rock Engineering and Exploration.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	Stress: Concepts of force and stress, units, classification, stresses at a point and on a plane, Mohr circle construction and stress trajectory. Stress changes within the earth, Stresses and crustal deformation, Origin of fractures and faults and their relationship to stress, Concept of rock strength and failure.	8	Understand the force picture of deformation
2	Strain: Concept of material movement during deformation and strain, strain parameters, classification, Derivation of strain matrix in 2D and 3D, strain ellipsoid and their relationships with geological deformation.	6	Understanding of the movement picture of material point during deformation
3	Strain Analysis: Measurement of deformation in nature, graphical representation by Flinn, Ramsay, Hossack and Mohr diagrams, progressive deformation, deformation paths and significance of geological structures. Applications of strain analysis in crustal deformations	6	Understand the kinematic processes related to rock deformation
4	Experimental Deformation and Rheology: Behaviour of rocks under experimental conditions. Effects of confining pressure, pore fluid pressure, anisotropy, temperature and scale on rock deformation.	4	Knowledge on fracturing of rocks and their analysis under applied stress
5	Development of Structures - I: Mechanisms of folding, and strain variations around folds. Development of tectonic cleavage and lineations and their kinematics	8	Gain insights on how folds and penetrative structures develop in deformed rocks
6	Development of Structures - II: Development of rock fractures. Conditions of fault development.	5	Understand how fractures and faults develop.
7	Development of Structures - III: Development of shear zones and shear zone indicators, strain within shear zones	5	Understand how shear zones develop

	Total	42	
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Text Book:

1. Means, W.D. (1976) Stress and Strain. Springer-Verlag.
2. Ramsay, J.G. (1967) Folding and Fracturing of Rocks. McGraw-Hill.

Reference Books:

1. Passchier, C.W., and Trouw, R.A.J. (1996). Microtectonics, Springer.
2. Ramsay, J.G. & Huber, M.I. (1983). The Techniques of Modern Structural Geology. Vol. 1. Academic Press.
3. Ramsay, J.G. & Huber, M.I. (1987). The Techniques of Modern Structural Geology. Vol. 2. Academic Press.
4. Twiss, R.J. & Moores, E.M. (1992) Structural Geology. W.H. Freeman & Company. Page 45 of 55
5. Turcotte, D.L. & Schubert, G. (2002). Geodynamics (2nd Edition). Cambridge University Press
6. Van der Pluijm, B.A. & Marshak, S. (2004). Earth Structure: An Introduction to Structural Geology and Tectonics (2nd Edition). WW Norton & Company.