

Structural Geology

1.1. Course Number: GE 213

1.2. Contact Hours: 3-0-2 Credits: 11

1.3. Semester Offered: 2nd Year-Even

1.4. Prerequisite: Basic knowledge of Geology and Physics

1.5. Syllabus Committee Members: Dr. Alok Kumar Singh & Dr. Hemant Kumar Singh

2. Objective: The course intent is to introduce the concept of stresses acting in the Earth and its resultant structural changes, types and Mechanism of Faulting and Folding, unconformity, and planar and linear fabrics.

3. Course Content: Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-topics	Lectures
1	Structure and Topography	Outline of Structural Geology, Primary and Secondary structures, Importance of primary structures in structural geology (bedding, graded bedding, top and bottom criteria, cross stratification, ripple marks, sole marks pinch and swell structures, and primary volcanic and plutonic structures), Properties of rocks and their controlling factors; Effects of topography on structural features, Topographic and structural maps; Importance representative factors of the map.	10
2	Stress and Strain in rocks	Concept of Stress and Strain in rocks; Two-dimensional stress analyses, Theories of Rock failure, Concept of dip and strike, Outcrop patterns of different structures	8
3	Folds and Unconformity	Fold morphology, Geometric and genetic classification of folds; Introduction to the mechanics of folding: Buckling, Bending, Flexural slip and flow folding, Description and origin of Unconformity, Unconformity classification, significance of unconformity	9
4	Fault & Joints	Geometric and genetic classification of fractures and faults, Recognition of faults, dynamics analysis of faulting, Effects of faulting on the outcrops Geologic/geomorphic criteria for recognition of faults and fault plane solutions, Ductile Shear Zones, Geometry and products of shear zones: Mylonites and cataclastites, General characteristic of fractures and joints, Classification of joints and Joint related structures.	10

5	Planar and Linear Fabrics	Description and origin of foliations: axial plane cleavage and its tectonic significance, Description and origin of lineation and relationship with the major structures	3
Total			40

List of experiments:

- Study of major structure in hand specimens.
- Presentation and interpretation of advanced geological maps and structural contour maps of inclined strata, folds, faults and unconformities.
- Basic idea of topographic contours, Topographic sheets of various scales.
- Introduction to Geological maps: Lithological and Structural maps Structural contouring and 3-point problems of dip and strike.
- Drawing profile sections and interpretation of geological maps of different complexities.
- Stereographic Projections (equal area) for presenting different types of fabrics, and π and β diagrams.

4. Readings:

4.1. Textbook:

- Pollard, D. D. (2005) Fundamental of Structural Geology. Cambridge University Press.
- Billings, M. P. (1987) Structural Geology, 4th edition, Prentice-Hall.
- Park, R. G. (2004) Foundations of Structural Geology. Chapman & Hall.
- George H. Davis, Stephen J. Reynolds, ad Charles F. Kluth (2011) Structural Geology of Rocks and Regions, 3rd edition, John Wiley & Sons, INC

4.2. Reference Books:

- Haakon Fossen (2016) Structural Geology, Cambridge University Press
- Ragan, D. M. (2009) Structural Geology: an introduction to geometrical techniques (4th Ed). Cambridge University Press
- Lahee F. H. (1962) Field Geology. McGraw Hill
- Ghosh, S.K., 1993, Structural Geology: fundamentals and modern developments, Pergamon, Oxford, 598 p.

5. Outcome of the course:

On completion of Course, the students should be able to:

- Predict the concept of stress forces acting in the earth's and its resultant structural changes. The geometry, Types and Mechanism of Faulting and Folding.
- Explain the concept of strain and its effects on Geometry.

Assess the theory of plate tectonics and describe how the outer part of the earth broken into large fragments (plates) that are always in motion relative to each other.