

Indian Institute of Technology Kanpur
Department of Civil Engineering
Proposal for a New Course

1. Course No: CE XXX

2. Course Title: Slope Stability and Landslides Analysis

3. Per Week: Lectures: 3 (L), Tutorial: 0 (T), Laboratory: 0 (P), Additional Hours: 0

Credits: 9 credits

Duration of Course: Full Semester

4. Proposing Department/IDP: Civil Engineering

Other Departments/IDPs which may be interested in the proposed course: NA

Other faculty members interested in teaching the proposed course: Dr. Gaurav Tiwari and Dr. Arghya Das

5. Proposing Instructor: Dr. Jagdish Prasad Sahoo

6. Course Description:

A) Objectives:

The identification of the stable state of a sloping ground is important to control the geohazards owing to landslides, where a large variety of geomaterials such as rock, debris, and soil move rapidly downward or outward of the sloping ground located in hilly and mountainous regions. This course is designed to provide: (i) an understanding of the mechanism of the instability of slopes leading to landslides; (ii) to understand the importance of geological, geotechnical, hydrological, topographical, meteorological, seismological, and anthropogenic factors towards the instability of slopes and landslides; (iii) to have an idea about monitoring and controlling techniques for identification and prevention of landslides.

B) Contents:

S. No.	Broad title	Topics	No. of Lectures
1	Types and states of slopes, and occurrence and classification of landslides	Natural and human-made slopes; infinite and finite slopes; concept of instability of slopes; stable, marginally stable, and actively unstable state of slopes; preconditioning, preparatory, and triggering factors involved in the process of instability of slopes and on the occurrence of landslides; landslide classifications based on material type, mechanisms of movement, rate of movement, degree of disruption of the displaced mass, and activity	05

2	Factors causing landslides and various types landslides	Importance of topographical, geological, geotechnical, hydrological, meteorological, seismological, and anthropogenic factors causing landslides. coseismic landslides, volcanic landslides, glacier landslides, Paleolandslides etc.	06
3	Slope stability analysis	Soil slopes: method of slices, friction circle methods, Bishop's modified method, Janbu's method, Morgenstern and Price, Spencer's method considering the influence of groundwater and seismic forces Rock slopes: Planar failure, wedge failure, circular failure, toppling failure considering the influence of groundwater and seismic forces	10
4	Landslide hazards and risks analysis	Hazards associated with various types of landslides based on their volume and velocity, activity, and runout from the landslide inventories and case studies.	05
5	Landslide susceptibility evaluation	Instrumentation and monitoring of slopes and slope movements by various techniques like extensometer, tiltmeter, satellite techniques, remote sensing techniques	06
6	Landslide controlling techniques	Various strengthening measures, stabilization of slopes by drainage methods, use of synthetic filters, retaining walls, concreting, rock bolting, and rock anchoring.	08

C) Pre-requisites, if any.

D) Short summary for including in the Courses of Study Booklet:

This course will give a broad view of natural and human-made slopes and their stability states leading to landslides, covering the importance of various factors affecting the state of slopes and causing landslides. The course will cover the basics and fundamentals of soil and rock mechanics and their applications in the analysis of slopes and landslides. An understanding of landslide hazards that potentially affect society and landslide risk analysis will help in reducing future hazards and disasters. The course will provide various techniques to evaluate the susceptibility of sloping ground to landslides and the methods to control landslide hazards.

7. Recommended books and materials:

Reference Books/Manuals:

1. Giani, G.P (1992) “Rock Slope Stability Analysis”, A A Balkema.
2. Chowdhary Robin (2012) “Geotechnical Slope Analysis”, CRC Press.
3. Robert L. Schuster and Raymond I. Krizek (1978) Landslides: Analysis and Control, Transportation Research Board, National Research Council (U.S.).
4. Lynn M. Highland, and Peter Bobrowsky (2008). The Landslide Handbook— A Guide to Understanding Landslides. USGS.
5. Kyoji Sassa, Hiroshi Fukuoka, Fawu Wang, and Gonghui Wang (2005). Landslides Risk Analysis and Sustainable Disaster Management. Springer

8. Any other remarks: The course is developed for PG students with a background in Civil engineering. However, UG students can register with a background in the course CE252.

Dated: 03/04/2025

Proposer: Jagdish Prasad Sahoo

Dated:

DPGC Convener:

The course is approved or not

Chairman, SPGC

Dated: