Course Title: Earth and Earth Surface Processes			
Course code: UES 110	**No. of credits: 3**	**L-T-P: 39-6-0**	**Learning hours: 45**
Pre-requisite course code and title (if any):			
Department: Natural and Applied Sciences			
Course coordinator:		**Course instructor:**	
Contact details:			
Course type: Major		**Course offered in:** Semester 2	

Course Description

This course provides introductory knowledge of the Earth, its materials, and surface processes. Due to the Earth's dynamic nature, these processes not only shape the Earth's surface but also influence the environment. Therefore, any geomorphic or environmental changes caused by these surface processes need to be studied carefully before exploiting natural resources or implementing human interventions. The course content covers the origin of the Earth, its structure, and terrestrial processes. A combined understanding of these topics offers students a basic knowledge of the Earth and its environment. It will also help in developing foundational knowledge for any future advanced environmental or Earth system studies.

Course objectives

The course aims to build the following understanding among students:

- Understanding of the origin of Earth, its structure, composition, and surface processes
- Understanding of earth materials and their distribution on the globe
- Understanding of geomorphology and its processes

Course content

Module	Topic	L	T	P
1	**Origin and Structure of Earth**			
	Being an introductory module in earth sciences, this module familiarizes students with the following concepts regarding the origin, history, and structure of the Earth: Brief introduction to theories of planet formation, origin of the Earth, layered structure of Earth; and composition of core, mantle, and crust	8		
2	**Plate-Tectonics**			
	To develop a comprehensive understanding of plate tectonic theory, its historical development, and its role in explaining major geological phenomena such as earthquakes, volcanism, and mountain formation. Plate-tectonics: concept of plate tectonics, seafloor spreading and continental drift; earthquakes and earthquake belts; volcanoes- types, products, and distribution of volcanic belts; orogeny; Case studies on Plate-tectonics	10		
3	**Earth materials**			
	To familiarize students with the types, properties, and formation processes of minerals and rocks, and to highlight their significance in Earth's structure. Minerals: classification, properties, and identification, Igneous, sedimentary, and metamorphic rocks, Rock cycle and processes, Economic importance of Earth materials	8	2	
4	**Geomorphology**			
	To explore the origin, types, and evolution of landforms through physical and chemical processes, and to equip students with tools to analyze and interpret surface features using geomorphological principles. Weathering and erosion processes, Soil formation and types. Landform development and classification, Fluvial, glacial, aeolian, and coastal geomorphology, Structural	8	2	

	and tectonic geomorphology.			
5	**Human impact on the Earth's surface processes**			
	To examine the dynamic processes operating at Earth's surface and human-induced changes, and to understand their impact on landscapes and ecosystems. Human impact on the Earth's surface processes. Mass Wasting. Drainage and sediment transport. Remote sensing and GIS in understanding the Earth's surface processes.	5	2	
	Total	39	6	0

Evaluation criteria

- Minor Test 1: Written test [at the end of teaching of modules 1] -- 15%
- Minor Test 2: Written test [at the end of teaching of module 3] -- 15%
- Major Test: Written test [at the end of the semester, full syllabus] -- 50%
- Assignment: 20%

Learning outcomes

Upon completion of the course, the students will be able to:

- understand the origin of planetary system, Earth and its structure [Module 1; Minor Test 1]
- understand the plate tectonic theory and associated formation [Modules 2 and 3; Minor Test 2]
- develop the understanding of landform formation and various earth surface processes. [Modules 4 and 5; Major Test]

Pedagogical approach

- The course will be delivered through lectures that focus on developing a clear foundation of the core concepts of the Earth processes and associated interactions.
- The course will also focus on classroom discussions and assignments to further develop the student's fundamental knowledge of the Earth processes.

Reading materials

- Bridge, J., Demicco, R. (2008) Earth surface processes, landforms, and sediment deposits. Cambridge University Press.
- Cronin, V.S. (2018). Laboratory manual in physical geology. Pearson.
- Grotzinger, J., Jordan, T.H. (2010). Understanding earth. Macmillan.
- Keller, E.A. (2011). Introduction to environmental geology. 5th Edition. Pearson Prentice Hall.
- Leeder, M., Arlucea, M.P. (2005). Physical processes in earth and environmental sciences. Blackwell Publishing.
- Ludman, A., Marshak, S. (2010). Laboratory manual for introductory geology. WW Norton & Company.
- McCann, T. (2021). Pocket guide geology in the field. Springer, Bonn, Germany.
- Pelletier, J.D. (2008). Quantitative modeling of earth surface processes (Vol. 304). Cambridge University Press. Chicago.
- Rutford, R.H., Carter, J.L. (2018). Zumberge's laboratory manual for physical geology. 16th Edition. McGraw-Hill Education, New York, USA.

Research articles

- Bull, W. B. (1991). Geomorphic responses to climatic change.
- Cremeens, D. L. (2012). The Earth's Land Surface: Landforms and Processes in Geomorphology. Kenneth J. Gregory, 2010, SAGE Publications, Ltd, xi+ 348 pp., ISBN 9781848606203, $53 (paperback).
- Mani, P., Allen, S., Evans, S. G., Kargel, J. S., Mergili, M., Petrakov, D., & Stoffel, M. (2023). Geomorphic process chains in high-mountain regions—A review and Classification approach for natural hazards assessment. *Reviews of Geophysics*, *61*(4).
- Swanson, F. J. (1981). Fire and geomorphic processes. *Mooney, HA; Bonnicksen, TM; Christensen, NL; Lotan, JE*, 401-444.

Student Responsibilities

The students are required to come prepared with readings that are suggested during the class and ensure timely submission of assignments. They are also expected to participate and further strengthen their understanding of concepts through classroom discussions.

Course Designed by:

- Dr. Chandrashekhar Azad Vishwakarma, Assistant Professor, Department of Natural and Applied Sciences, TERI School of Advanced Studies

Course Reviewers:

The course is reviewed by following reviewers:

- Dr. Jayant Kumar Tripathi, Professor, School of Environmental Sciences, Jawaharlal Nehru University, New Delhi
- Dr. Ram Avtar, Associate Professor, Faculty of Environmental Earth Science, Hokkaido University, Japan