

Course title: Advanced Geosciences				
Course code: NRE 170		No. of credits: 3	L-T-P: 34-08-0	Learning hours: 42
Pre-requisite course code and title (if any): Environmental Geosciences				
Department: Energy and Environment				
Course coordinator: Dr Chubamenla Jamir/Dr CK Singh			Course instructor: Dr Chubamenla Jamir/Dr CK Singh	
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Course type: Core			Course offered in: Semester 2	
Course Description				
<p>The earth is facing several developmental challenges such as environmental pollution, depletion of natural resources and global climate change. All these challenges are intrinsically linked with the various components of the Earth's systems and its processes. Thus, for addressing the various global developmental challenges, knowledge on the Earth's physical functioning and its inter-linkages with the various developmental aspects is essential.</p> <p>This course aims to introduce the students to a detailed analysis of the key processes of the Earth's system and its linkages with natural disasters and anthropogenic interferences.</p> <p>The course will provide the necessary knowledge and skillsets to the students for analyzing the trends in Earth's environment and the causative agents.</p>				
Course objectives				
<ul style="list-style-type: none"> • This course will introduce the students to key processes of the Earth's system related to the developments. • It will enable them to understand the effects of anthropogenic interferences on Earth's functioning, and its impact on geological/geomorphological changes. 				
Course content				
Module	Topic	L	T	P
1.	Introduction Earth structure; Geologic Time Scale; Dynamics of Geological Processes;	4		
2.	Earth processes (interior and surface) Tectonic Geomorphology - geomorphic indicators of tectonic activity and paleoseismicity Mass movement – classification; Hillslope evolution and stabilization Floodplains – channel and flood plain evolution; Streams - processes of transport, depositional features, drainage patterns Coastal zones and processes – nature of coastline (emergent and submergent coastlines), coastal erosion and stabilization Deserts and desertification, wind action (erosional and transport processes), semiarid regions - features and processes Glaciers – classification and dynamics, erosional features and deposits Weathering – mechanical, chemical and biological weathering, weathering of silicate minerals	12	4	
3.	Natural Resources Water- Surface and Groundwater Soil – genesis, classification, degradation, soil survey and land use planning, Soil map of India	6		
4.	Mineral resources Metal and non-metal mineral deposits, Hydrocarbons and Radioactive mineral deposits for energy; Global mineral supplies; Ore deposits in India, National mineral policy.	4		

	Issues related to over-exploitation of resources and pollution.			
5.	Field and Laboratory Methods in Environmental Geoscience Interpretation of geologic maps; Geophysical logging and interpretation; Data mining and data analysis/interpretation in geosciences; Map reading, Geological cross-section preparation, Use of Brunton compass to read the attitude and dip of the geological formation. Hand specimens of rocks and minerals.	8	4	
	Total	34	8	0
Evaluation criteria				
<ul style="list-style-type: none"> ▪ Test 1: 20% ▪ Test 2: 20% ▪ Test 3: 40% ▪ Assignment: 20% 				
Learning outcomes				
<ul style="list-style-type: none"> • The student will gain understanding of earth's interior and surface processes (Test 1) • Understand the earth's geological processes (Test 2) • Gain understanding techniques to gather geological information (Test 3 and assignment) 				
Pedagogical approach				
Pedagogical approach consists of classroom teaching enriched with theories, frameworks, and methods combined with hands on exercises on application of tools and techniques, discussion of case studies, presentation of case studies by students.				
Materials				
Required text				
<ol style="list-style-type: none"> 1. H. Chamley (2003). Geosciences, Environment and Man. Elsevier Science. 2. C. Montgomery (2020) Environmental Geology. McGraw-Hill Education 3. E.A. Keller (2012) Introduction to Environmental Geology. Pearson Education. 4. K.S. Valdiya (2013). Environmental Geology: Ecology, Resource and Hazard Management. Tata McGraw-Hill Education 5. B.R. Frost and C.D. Frost (2019). Essentials of Igneous and Metamorphic Petrology, Cambridge University Press. 6. S. Boggs Jr. (2012) Principles of Sedimentology and Stratigraphy. Pearson Education. 7. J.I. Drever (1997) The Geochemistry of Natural Waters: Surface and Groundwater Environments. Prentice-Hall Publishers 8. K.M. Hiscock and V.F. Bense (2014) Hydrogeology: Principles and Practice. Wiley-Blackwell. 9. N. Lu and J.W. Godt (2013) Hillslope Hydrology and Stability. Cambridge University Press. 10. R.J. Huggett (2017). Fundamentals of Geomorphology. Taylor & Francis. 11. D.L. Turcotte and G. Schubert (2014). Geodynamics. Cambridge University Press. 12. R.S. Anderson and S.P. Anderson (2010) Geomorphology: The Mechanics and Chemistry of Landscapes. Cambridge University Press. 13. Edwards R. and Atkinson K. (1986); Ore Deposit Geology, and its Influence on Mineral Exploration. Chapman and Hall. 14. M.L. Jenson and A.M. Bateman (2013), Economic Mineral deposits. John Wiley 15. S. Marshak and G. Mitra (2017). Basic Methods of Structural Geology. Pearson Education. 16. A.L. Coe (Ed.) (2010) Geological Field Techniques. Wiley-Blackwell. 				
Suggested readings				
Case studies				
<ul style="list-style-type: none"> • Schiappa, T.A. and Smith, L., 2019. Field experiences in geosciences: A case study from a multidisciplinary geology and geography course. Journal of Geoscience Education, 67(2), 				

pp.100-113.

- Dolphin, G., Dutchak, A., Karchewski, B. and Cooper, J., 2019. Virtual field experiences in introductory geology: Addressing a capacity problem but finding a pedagogical one. *Journal of Geoscience Education*, 67(2), pp.114-130.
- Gilley, B., Atchison, C., Feig, A. and Stokes, A., 2015. Impact of inclusive field trips. *Nature Geoscience*, 8(8), pp.579-580.
- Hallar, A.G., McCubbin, I.B., Hallar, B., Levine, R., Stockwell, W.R., Lopez, J.P. and Wright, J.M., 2010. Science in the mountains: A unique research experience to enhance diversity in the geosciences. *Journal of Geoscience Education*, 58(2), pp.95-100.

Journals

- Nature Geoscience
- Journal of Structural Geology
- Geoscience Frontiers
- Geosciences Journal, Springer

Advanced Reading Material

Additional information (if any)

Student responsibilities

The students are expected to submit assignments in time and come prepared with readings when provided

Course Reviewers:

1. Dr. Umesh Kumar Singh, Professor, Department of Environmental Science, School of Earth, Biological and Environmental Sciences, Central University of South Bihar, Bihar
2. Dr. Saumitra Mukherjee, Professor, School of Environmental Sciences, Jawaharlal Nehru University, New Delhi