Vidyasagar University

Curriculum for B.Sc. (Honours) in Geology [Choice Based Credit System]

Semester-VI

Course	Course Code	Name of the Subjects	Course Type/ Nature	Teaching Scheme in hour per week			Credit	Marks
				L	T	P		
CC- 13		**C13T:** Geomorphology, Remote Sensing and GIS	Core Course-13	4	0	0	6	75
		- Lab		0	0	4		
CC- 14		**C14T**: Engineering Geology	Core Course-14	4	0	0	6	75
		- Lab		0	0	4		
DSE-3		**TBD**	Discipline Specific Electives -3	4	0	4	6	75
DSE-4		**TBD**	Discipline Specific Electives -4	5	1	0	6	75
Semester Total							**24**	**300**

L= Lecture, **T=** Tutorial, **P =** Practical, **CC -** Core Course, **TBD -** To be decided, **DSE:** Discipline Specific Elective.

Semester-VI

List of Core Course (CC)

CC-13: Geomorphology, Remote Sensing and GIS

CC-14: Engineering Geology

Discipline Specific Electives (DSE)

DSE-3: Exploration Geology
Or
DSE-3: River Science

DSE-4: Oceanography & Marine science
Or
DSE-4: Geodynamics

SEMESTER –VI

Core Courses (CC)

CC-13: Geomorphology, Remote Sensing and GIS — Credits 06

C13T: Geomorphology, Remote Sensing and GIS — Credits 04

Course Contents:

Unit-1: Introduction to Geomorphology

1. Introduction to Geomorphology
2. Relationship between the landforms and the properties of earth material and differentkind of processes
3. Endogenic and Exogenic processes

Unit-2

1. Geoid, Topography, Hypsometry, Major Morphological features of the earth surface
2. Large Scale Topography - Plate tectonics overview. Large scale mountain ranges (with emphasis on Himalaya)

Unit-3

Surficial Processes and geomorphology, Weathering and associated landforms, Hill slopes Glacial, Periglacial processes and landforms, Fluvial processes and landforms, Aeolian Processes and landforms, Coastal Processes and landforms, Landforms associated with igneous activities

Unit-4

1. Endogenic- Exogenic interactions. Rates of uplift and denudation. Tectonics and drainage development, Sea-level change, Long-term landscape development.
2. Landform dating techniques.

Unit-5: Remote Sensing, Concepts in Remote Sensing

1. Concepts in Remote Sensing.
2. Sensors and scanners.
3. Satellites and their characteristics.
4. Data formats- Raster and Vector.

Unit-6: Photogeology

1. Types and acquisition of aerial photographs; Scale and resolution; Principles of stereoscopy, relief displacement, vertical exaggeration and distortion

2. Elements of air photo interpretation
3. Identification of sedimentary, igneous and metamorphic rocks and various aeolian, glacial, fluvial and marine landforms

Unit-7: Digital Image Processing

1. Image Errors, Rectification and Restoration, FCC, Image Enhancement, Filtering, Image Rationing.
2. Image classification and accuracy assessment.
3. GIS integration and Case studies-Indian Examples.

Unit-8: GIS and GPS

1. Datum, Coordinate systems and Projection systems.
2. Spatial data models and data editing.
3. Introduction to DEM analysis.
4. Concepts of GPS.
5. Integrating GPS data with GIS.
6. Applications in earth system sciences.

Suggested Readings:

1. Robert S. Anderson and Suzzane P. Anderson (2010): Geomorphology - The Mechanicsand Chemistry of Landscapes. Cambridge University Press.

2. M.A. Summerfield (1991) Global Geomorphology.Wiley & Sons.

3. Demers, M.N., 1997.Fundamentals of Geographic Information System, John Wiley &sons. Inc.

4. Hoffmann-Wellenhof, B., Lichtenegger, H. and Collins, J., 2001. GPS: Theory & Practice,Springer Wien New York.

5. Jensen, J.R., 1996. Introductory Digital Image Processing: A Remote SensingPerspective, Springer-Verlag.

6. Lillesand, T. M. & Kiefer, R.W., 2007.Remote Sensing and Image Interpretation, Wiley.

7. Richards, J.A. and Jia, X., 1999.Remote Sensing Digital Image Analysis, SpringerVerlag.

C13P: Geomorphology, Remote Sensing and GIS Lab Credits 02

List of Practical

1. Reading topographic maps. Preparation of a topographic profile.
2. Preparation of longitudinal profile of a river.

3. Calculating Stream length gradient index
4. Morphometry of a drainage basin.
5. Interpretation of geomorphic processes from the geomorphology of the area.
6. Aerial Photo interpretation: Identification of sedimentary, igneous and metamorphic rocks and various aeolian, glacial, fluvial and marine landforms.
7. Introduction to DIP and GIS softwares.
8. Digital Image Processing exercises including analysis of satellite data in different bands and interpretation of various objects on the basis of their spectral signatures.
9. Registration of satellite data with a toposheet of the area.
10. DEM analysis: generating slope map, aspect map and drainage network map and its applications.
11. Use of stereoscope. Flight line determination using aerial photograph.

CC-14: Engineering Geology Credits 06

C14T: Engineering Geology Credits 04

Course Contents:

Unit-1
Role of engineering geologists in planning, design and construction of major man-made structural features.

Unit-2
Site investigation and characterization

Unit-3
Foundation treatment; Grouting, Rock Bolting and other support mechanisms

Unit-4
Rock aggregates; Significance as Construction Material

Unit-5

Concept, Mechanism and Significance of:

a) Rock Structure Rating (RSR)
b) Rock Mass Rating (RMR)
c) Tunneling Quality Index (Q)
Geological, Geotechnical and Environmental considerations for Dams and Reservoirs

Unit-6
Tunnels and Tunneling Methods

Unit-7
Landslides: Causes, Factors and corrective/Preventive measures

Unit-8

Earthquakes: Causes, Factors and corrective/Preventive measures. Mitigating the damagecaused by Earthquake

Unit-9
Case histories related to Indian Civil Engineering Projects

Suggested Readings:

1. Krynin, D.P. and Judd W.R. 1957.Principles of Engineering Geology and Geotechnique, McGraw Hill (CBS Publ).
2. Johnson, R.B. and De Graf, J.V. 1988.Principles of Engineering Geology, John Wiley. Goodman, R.E., 1993.Engineering Geology: Rock in engineering constructions. JohnWiley & Sons, N.Y.
3. Waltham, T., 2009. Foundations of Engineering Geology (3rd Edn.)Taylor & Francis.
4. Bell: F.G-, 2006. Basic Environmental and Engineering Geology Whittles Publishing.
5. Bell, .F.G, 2007. Engineering Geology, Butterworth-Heineman

C14P: Engineering Geology Lab — Credits 02

List of Practical

1. Computation of reservoir area, catchment area, reservoir capacity and reservoir life.
2. Merits, demerits & remedial measures based upon geological cross sections of project sites.
3. Computation of Index properties of rocks.
4. Computation of RQD, RSR, RMR and ‘Q

Suggested Readings:

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, AsiaPublishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition,reprinted 1985, Heinemann Educational Publishers.
3. A Text Book of Practical Physics, I.Prakash& Ramakrishna, 11th Ed., 2011, Kitab Mahal.
4. Electromagnetic Field Theory for Engineers & Physicists, G. Lehner, 2010, Springer

Discipline Specific Electives (DSE)

DSE-3: Exploration Geology — Credits 06

DSE3T: Exploration Geology — Credits 04

Course Contents:

Unit-1: Mineral Resources

Resource: Definitions, Mineral resources in industries – historical perspective and present scenario, classification of mineral deposits with respect to processes of formation; exploration strategies.

Unit-2: Prospecting and Exploration

1. Principles of mineral exploration
2. Prospecting and exploration: conceptualization, methodology and stages, Sampling, subsurface sampling including pitting, trenching and drilling
3. Geochemical exploration.
4. Outline of exploration techniques for ferrous and non-ferrous metals, limestone and coal and petroleum.

Unit-3: Evaluation of data

Evaluation of sampling data - Mean, mode, median, standard deviation and variance

Unit-4: Drilling and Logging

1. Core and non-core drilling
2. Planning of bore holes and location of boreholes on ground Core-logging

Unit-5: Reserve estimations and Errors

1. Principles of reserve estimation, Factors affecting reliability of reserve estimation.
2. Reserve estimation based on geometrical models (square, rectangular, triangular and polygon blocks).
3. Regular and irregular grid patterns.
4. Statistics and error estimation.

Suggested Readings:

1. Clark, G.B. 1967. Elements of Mining.3rd Ed. John Wiley & Sons.
2. Arogyaswami, R.P.N. 1996 Courses in Mining Geology. 4 th Ed. Oxford- IBH.
3. Moon, C.J., Whateley, M.K.G., Evans, A.M., 2006, Introduction to Mineral Exploration, Blackwell Publishing.

DSE3P: Practical Credits 02

List of Practical

1. Identification of anomaly: Gravity and Magnetic.
2. Concept of weighted average in anomaly detection.

3. Geological cross-section.
4. Models of reserve estimation.

OR

DSE-3: River Science — Credits 06

DSE3T: River Science — Credits 04

Course Contents:

Unit-1: Stream hydrology

1. Basic stream hydrology
2. Physical properties of water, sediment and channel flow
3. River discharge, River hydrographs (UH, IUH, SUH, GIUH) and its application in hydrological analysis
4. Flood frequency analysis

Unit-2: River basin

1. Sediment source and catchment erosion processes Sediment load and sediment yield
2. Sediment transport processes in rivers
3. Erosion and sedimentation processes in channel.

Unit-3: Drainage

1. Drainage network
2. Quantitative analysis of network organization – morphometry, Random Topology (RT) model and fractal analysis
3. Role of drainage network in flux transfer
4. Evolution of drainage network in geological time scale.

Unit-4: Rivers in time and space

1. River diversity in space, Patterns of alluvial rivers - braided, meandering and anabranching channels, Dynamics of alluvial rivers
2. Channel patterns in stratigraphic sequences
3. Different classification approaches in fluvial geomorphology and its applications.

Unit-5: Channels and Landscapes

1. Bedrock channels, Bedrock incision process
2. River response to climate, tectonics and human disturbance
3. Bedrock channel processes and evolution of fluvial landscapes.

Unit-6: Fluvial hazards

1. Integrated approach to stream management
2. Introduction to river ecology

Suggested Readings:

1. Davies, T. (2008): Fundamentals of hydrology. Routledge Publications.
2. Knighton, D. (1998): Fluvial forms and processes: A new perspective. Arnold Pubs.
3. Richards. K. (2004): Rivers: Forms and processes in alluvial channels. Balckburn Press.
4. Bryirely and Fryirs (2005): Geomorphology and river management. Blackwell Pub.,
5. Julien, P.Y. (2002): River Mechanics. Cambridge University Press.
6. Robert, A. (2003): River Processes: An introduction to fluvial dynamics. Arnold Publications.
7. Vanoni, V.A. (2006): Sedimentation Engineering. ASCE Manual, Published by American Society of Civil Engineering,
8. Tinkler, K.J., Wohl, E.E. (eds.) 1998: Rivers over rock. American Geophysical Union Monograph, Washington, DC.

DSE3P: Practical **Credits 02**

List of Practical

1. Stream power calculation longitudinal profile analysis
2. Hydrograph analysis and other related problems

DSE-4: Oceanography & Marine science Credits 06

DSE4T: Oceanography & Marine science

Course Contents:

Unit-1: Fundamentals of Ocean

1. Concept of land and Ocean. Land-Ocean distribution
2. Marine Provinces
3. Plate Tectonics and Sea Floor spreading

Unit-2: Chemical and Physical aspects of Ocean

1. Ocean dynamics
2. Ocean Chemistry
3.Marine Sediments

4. Sea Water: Composition, Controls on sea water composition
5. Sea-Air Interaction

Unit-3: Waves, Tides and Coasts

1. Ocean Circulation
2. Waves and Water Dynamics
3.Ocean Energy
4. The Coast: Beaches and Shoreline
5. The Coastal Ocean - Migration for Coastal Erosion

Unit-4: Life in the Ocean

1. Marine Life and the Environment
2. Biologic Productivity and in Ocean
3.Animals of the Pelagic Environment and Life
4. Animals of the Benthic environment and Life

Suggested Readings:

1. Introductory Oceanography by Harold V. Thurman, Mt. San Antonio College ,Charles E. Merrill Publishing Company.
2. Oceanography for Beginners, by Pronab K. Banerjee, Allied Publishers Pvt Limited
3. Coastal Hydraulics, by A. M. Muir and C. A. Fleming 1981, The MacMillan Press Ltd, London.

OR

DSE-4: Geodynamics Credits 06

DSE4T: Geodynamics

Course Contents:

Unit-1: Introduction

1. Definition. Continents and oceans. Continental and oceanic crust. Internal processes of earth
2. Concept of lithosphere and asthenosphere. Physical character of lithosphere and asthenosphere. Concept of plate.
3. Concept of hot spot and mantle plume. Ophiolites. Palaeomagnetism.

Unit-2: Continental Drift, Sea floor spreading and Plate tectonics

1. Wegner Continental drifts hypothesis and its evidences. Continental position in the past
2. Sea-floor spreading process and its evidences.
3. Plate tectonics model and its evidences. Distribution of plates in the Earth

Unit-3: Plate and Plate boundaries

1. Plates: Physical character of plates. Macro and micro plates.
2. Plate boundaries: types, character, Identification of boundaries. Movement of plates along boundaries. Plate velocities.
3. Volcanic arcs, island arcs, trenches, accretionary prisms, oceanic ridges, transform faults. Magmatism in oceanic ridges and in subduction zones

Unit-4:

1. Palaeomagnetism and motion of plates
2. Driving mechanisms of plates.Plate tectonics and mantle convection.
3. Supercontinents and their breakup and assembly. Wilson cycle

Suggested Readings:

1. Turcotte, D.L. and Schubert, G. Geodynamics. Second Edition. Cambridge
2. Kearey, P., Klepeis, K. A., and Vine, F. J. (2009). Global Tectonics. Third edition. Wiley Blackwell, Oxford.