Appendix-37
Resolution No. 14-1 (14-1-6)

INDEX

DEPARTMENT OF GEOLOGY

DISCIPLINE SPECIFIC CORE COURSE -10 (DSC-10) – : Geomrphology

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)	No. of hours of Lectures	No. of hours of Tutorial	No. of hours of Practical	Total Hours of Teaching
		Lecture	Tutorial	Practical/ Practice						
Geomorphology (DSC-10)	4	3	0	1	Class XII with Science	Studied Earth System Science and Equivalent at the UG level				

Course Objectives

The main aim of this course is to learn about the fundamentals of Geomorphology.

Learning outcomes

In this course a student will learn about 1) the advantages to study geomorphology, 2) fundamentals of working of earth surface processes, and 3) various geomorphic techniques, 4) geomorphology of India, and 5) extra-terrestrial landforms.

SYLLABUS OF DSC-7

UNIT – I (9 hours)

Detailed content

Introduction to Geomorphology: Geosphere-Hydrosphere-Biosphere; Unifying concepts

UNIT – II (9 hours)

Detailed contents

Geoid, Topography, Hypsometry, Global Hypsometry, Major Morphological features Large Scale Topography - Ocean basins, Plate tectonics overview, Large scale mountain ranges (with emphasis on Himalaya)

UNIT – III (9 hours)

Detailed contents

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 – IV (9 hours))

Detailed contents

Dating Methods, measuring rates; Rates of uplift and denudation, Tectonics and drainage development, Sea-level change, Long-term landscape development

UNIT – V (9 hours)

Detailed contents

Overview of Indian Geomorphology; Introduction to Extra-terrestrial landforms

Practical Component- (30 Hours)

Reading topographic maps, Concept of scale, Preparation of a topographic profile, Preparation of longitudinal profile of a river, Preparing Hack Profile and Calculating Stream length gradient index, Morphometry of a drainage basin - Calculating different morphometric parameters, Preparation of geomorphic maps.

Essential/recommended readings

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

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

Suggestive readings

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

Paul R. Bierman and D.R. Montgomery (2014): Key Concepts in Geomorphology. W.H. Freeman and Company Publishers.

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

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.

DISCIPLINE SPECIFIC CORE COURSE – 11 (DSC-11): Hydrogeology

Credit distribution, Eligibility and Prerequisites of the Course

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)	No. of hours of Lectures	No. of hours of Tutorial	No. of hours of Practical	Total Hours of Teaching
		Lecture	Tutorial	Practical/ Practice						
Hydrogeology (DSC-11)	4	3	0	1	Class XII with Science	Studied Stratigraphy, Earth System Science or Equivalent at the UG level				

Learning Objectives

Main objective to the course is make students to comprehend about the nature, occurrence and movement of groundwater in geological context. To develop basic understanding about ground water exploration and management.

Learning outcomes

The course will introduce students to the fundamental concepts of hydrogeology. They will learn about occurrence and movement of groundwater, aquifers and their parameters, groundwater exploration methods, aspects of groundwater chemistry and groundwater management.

SYLLABUS OF DSC- 11

UNIT – I (9 hours)

Detailed contents

Introduction and basic concepts: Scope of hydrogeology and its societal relevance. Hydrologic cycle: precipitation, run-off, infiltration and subsurface movement of water. Hydrogeological formations: Aquifer; Aquitard; Aquiclude; Aquifuge. Vertical distribution of subsurface water. Types of aquifers, aquifer properties, anisotropy and heterogeneity of aquifers. Introduction to geologic formation as aquifers.

UNIT – II (9 hours)

Detailed contents

Groundwater flow: Darcy's law and its validity (discussions on laminar and turbulent groundwater flow), intrinsic permeability and hydraulic conductivity, Groundwater flow rates and flow direction.

UNIT – III (9 hours)

Detailed contents

Well hydraulics and Groundwater exploration: Basic Concepts of well hydraulics (drawdown; specific capacity etc). Elementary concepts related to: equilibrium conditions for water flow to a well in confined and unconfined aquifers, estimation of permeability in field and laboratory. Introduction to non-equilibrium groundwater flow condition. Surface-based groundwater exploration methods.

UNIT – IV (9 hours)

Detailed contents

Groundwater chemistry: Physical and chemical properties of water and water quality. Introduction to methods of interpreting groundwater quality data using standard graphical plots. Sea water intrusion in coastal aquifers.

UNIT – V (9 hours)

Detailed contents

Groundwater management: Basic concepts of water balance studies, issues related to groundwater resources development and management. Groundwater level fluctuations. Rainwater harvesting and artificial recharge to groundwater.

Practical Component- (30 Hours)

Preparation and interpretation of water level contour maps and depth to water level maps. Preparation and analysis of hydrographs for differing groundwater conditions. Graphical representation of chemical quality data and water classification (C-S and Trilinear diagrams). Simple numerical problems related to: estimation of permeability in field and laboratory, Groundwater flow, Well hydraulics etc.

Essential/recommended readings

Todd, D. K. 2006. Groundwater hydrology, 2nd Ed., John Wiley & Sons, N.Y.

Karanth K.R., 1987, Groundwater: Assessment, Development and management, Tata McGraw- Hill Pub. Co. Ltd.

Suggestive readings (if any)

Davis, S. N. and De Weist, R.J.M. 1966. Hydrogeology, John Wiley & Sons Inc., N.Y.

Raghunath, H.M. 2007. Groundwater, Third Edition, New Age International Publishers.

Shekhar Shashank . 2017a. Aquifer Properties. E-PG Pathshala, UGC, MHRD, Govt. of India. Available on: https://epgp.inflibnet.ac.in/ahl.php?csrno=448

Shekhar Shashank. 2017b. Darcy's law. E-PG Pathshala, UGC, MHRD, Govt. of India. Available on: https://epgp.inflibnet.ac.in/ahl.php?csrno=448

Shekhar Shashank. 2017c. Assessment of groundwater quality. E-PG Pathshala, UGC, MHRD, Govt. of India. Available on: https://epgp.inflibnet.ac.in/ahl.php?csrno=448

Syed Tajdarul Hassan. 2017a. Introduction to Hydrology. E-PG Pathshala, UGC, MHRD, Govt. of India. Available on: https://epgp.inflibnet.ac.in/ahl.php?csrno=448

Syed Tajdarul Hassan. 2017b. Hydraulic Head, Fluid Potential, Reynolds number and Pumping Tests-I. E-PG Pathshala, UGC, MHRD, Govt. of India. Available on: https://epgp.inflibnet.ac.in/ahl.php?csrno=448

Syed Tajdarul Hassan. 2017c. Hydraulic Head, Fluid Potential, Reynolds number and Pumping Tests-II. E-PG Pathshala, UGC, MHRD, Govt. of India. Available on: https://epgp.inflibnet.ac.in/ahl.php?csrno=448

DISCIPLINE SPECIFIC CORE COURSE– 12 (DSC-12): Geology of India

Credit distribution, Eligibility and Pre-requisites of the Course

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)	No. of hours of Lectures	No. of hours of Tutorial	No. of hours of Practical	Total Hours of Teaching
		Lecture	Tutorial	Practical/ Practice						
Geology of India (DSC-12)	4	3	0	1	Class XII with Science	Studied Earth System Science, Structural Geology, and Mineralogy or Equivalent at the UG level				

Learning Objectives

To make students acquainted with the overall geology of the Indian subcontinent
To make the students aware the dynamic geological history of the Indian subcontinent spanning from Archean to Quaternary
To make students understand roles of tectonics, climate and sea level in framing the geological history through time

Learning Outcomes:

The students will get a holistic understanding on the geological set up of India
The students will come to know the state-of-the-art understanding and will be prepared to take future challenges to carry out research in order to resolve key issues in Indian stratigraphy
.

SYLLABUS OF DSC-12

UNIT – I (9 hours)

Detailed contents
Physical and tectonic subdivisions of Indian subcontinent

UNIT – II (9 hours)

Detailed contents
Distribution of stratigraphic units in the Peninsula and in the Himalayas

UNIT – III (9 hours)

Detailed contents
Stratigraphy, geographic distribution, lithological characteristics, fossil contents and economic importance of Precambrian and Phanerozoic

successions of India: Precambrian basement rocks of Dharwar, Aravalli-Bundelkhand, Bastar, Singhbhum, central provinces of northeastern India; Proterozoic mobile belts in northwestern, central, eastern and southern Indian peninsular regions and in the extra-peninsula; Proterozoic basins including: Vindhyan, Cuddapah, Kurnool, Bhima, and Kaladgi.
Marine Paleozoic formations of India: Tethyan regions, Lesser Himalayan region.
Marine Mesozoic formations of India: Himalayan and Peninsular region.
Gondwana sequences of India.
Cenozoic formations in western, eastern, southern and Himalayan regions
Deccan Traps, Rajmahal Traps.
.

UNIT – IV (9 hours)

Detailed contents

Stratigraphic boundary problems in Indian Geology: Precambrian-Cambrian boundary; Permian-Triassic boundary; Cretaceous-Tertiary boundary.

UNIT – V (9 hours)

Glacial events in the Earth's history, stratigraphic implication of the sea-level changes in the Quaternary period and their significance in Indian subcontinent.

Practical Component- (30 Hours)

Study of rocks in hand specimens from the known stratigraphic horizons, Drawing various paleogeographic maps and tectonic maps of sedimentary basins. Study of different Proterozoic supercontinent reconstructions, Interpretation of various stratigraphic logs and their correlation.

Essential/recommended readings

Wadia,D.N. 1957. Geology of India, 3rd Ed., McMillan, London.
Ravindra Kumar, 1985. Fundamentals of historical geology and stratigraphy of India. Wiley Eastern Ltd., Delhi.
Ramakrishnan, M. & Vaidyanathan, R. (2008) Geology of India. Volume 1 & 2, Geological Society of India, Bangalore.

Suggestive readings

Wadia,D.N. 1957. Geology of India, 3rd Ed., McMillan, London.
Naqvi, S.M. and Rogers, J.J. 1986. Precambrian Geology of India. Clarendon Press.
Ravindra Kumar, 1985. Fundamentals of historical geology and stratigraphy of India. Wiley Eastern Ltd., Delhi.

Discipline Specific Elective (DSE-2): Introduction to Field Geology (L2, P2)

Or

One GE from GE pool (GE-4): Natural Hazards and Mitigation (T4, P0)

Credit distribution, Eligibility and Pre-requisites of the Course

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)	No. of hours of Lectures	No. of hours of Tutorial	No. of hours of Practical	Total Hours of Teaching
		Lecture	Tutorial	Practical/ Practice						
DSE-2 Introduction to Field Geology (L2, P1)	4	2	0	2	Class XII with Science	Studied Earth System Science and Structural Geology or Equivalent at the UG level				

Learning Objectives

Learn to investigate various sedimentary features, structures and landforms in the field. To learn how to extract information about an area through the investigation of topographic maps.

Learning outcomes

Through this course, students will learn to: Identify sedimentary structures in field, Learn to measure grain size analysis in the field, Prepare litholog and its importance, Identify structures in the field, Prepare and interpret profiles from the topographic maps

SYLLABUS OF DSE-2

UNIT – I (6 Hours)

Rock Particles and Fragments: characters of larger rock fragments, pebbles etc.; Shape and surface markings; Dimensions of Particles and fragments; composition; shape; angular particles; subangular particles; rounded particles;

UNIT – II (6 Hours)
Sedimentary Structures: process of formation and their interpretation; laminae, bed, ripple marks, wave marks, rill marks, mud cracks, slump marks, cross-stratifications etc. Importance of litholog (theory)

UNIT – III (6 Hours)
Deformed rocks: Tilted and folded strata; Principal kinds of folds or flexures; Types of folds; Strike, dip, plunge and pitch; Classification of faults; kinds of displacement; principal evidences of faulting; relation of folds and faults; Topographic expression of folds and faults.

UNIT – IV (6 Hours)
Landforms in various environment: Fluvial landforms, coastal landforms, aeolian landforms, and glacial landforms.

UNIT – V (6 Hours)
Topographic maps and profile sections: Contours; spacing of contours; scale; direction; requisite data on a completed contour map.
Techniques used in examination of outcrops.

Practical Component- (60 Hours)

- **Measuring large grain sizes in the field (Grid method)**
- Identification of sedimentary structures
- Preparation of litholog
- Identification of landforms (glacial/fluvial/coastal/aeolian)
- Identification of folds and faults; evidences of faulting
- Construction of a profile section; Enlargement of profile section.
- Measurement of slope from the topographic map.
- Location in the toposheet thorough GPS/bearing
- Measurement of dip, strike, trend, plunge, pitch
- Identification of bedding, flow banding, metamorphic foliation

Essential
Field Geology by F.H. Lahee, CBS Publishers
Basic geological mapping, R. Lisle, Wiley-Blackwell, 2014

Recommended readings
Sedimentary Rocks in the field, M. Tucker, Wiley-Blackwell, 2011

***** DSE Courses of Tectonic Evolution of the Himalayas, and Applications of thermodynamics in Petrology to be inserted.**

Credit distribution, Eligibility and Pre-requisites of the Course GE-4

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)	No. of hours of Lectures	No. of hours of Tutorial	No. of hours of Practical	Total Hours of Teaching
		Lecture	Tutorial	Practical/ Practice						
GE-4 Natural Hazards and Mitigation (L4, P0)	**4**	**3**	**1**	**0**	**12th Pass with Science**	**Nil**				

Learning Objectives

Main objective of this course is to educate and train students about the hazards and the ways to know reduce disaster the risks. This course provides a basic introduction to global natural hazards with a special emphasis on India—and the concept of disaster risk reduction. This course lays the foundation for advanced study in climate change impacts, environment science, sustainability, and disaster management.

Learning outcomes

After going through this course, student will have clear idea about the major natural hazards and disaster management terminology. They will know the genesis of different type of hazards with reference to the terrain and climate conditions. They will also have basin idea to assess the impact of natural hazards/climate change on human and environment.

SYLLABUS OF GE-4

UNIT – I (12 Hours)

Detailed contents

Introduction to natural hazards: Concept of hazards, vulnerability, exposure, risk and disaster. Major natural and manmade hazards and their impact.

UNIT – II (12 hours)

Detailed contents

Hydrometeorological hazards: Floods, storms/cyclone, cloudburst, heat and cold waves, genesis of hydrometeorological hazards, extreme events.

UNIT – III (12 Hours)

Detailed contents

Geological hazards: Geological processes and hazards. Different forms of mass movement: landslide, subsidence, debris flow; Volcanic hazards: major volcanic eruption, Earthquake and secondary hazard: Tsunami, snow avalanche.

UNIT – IV (12 Hours)

Detailed contents

Climate change and pandemic: Climate change, Global warming, sea-level rise, impact of climate change on natural resources. Global climate agreements; pandemics. Other natural hazards.

UNIT – V (12 Hours)

Detailed contents

Hazard mitigation: Hazard zonation; Early warning system; Engineering measures, Hazard/disaster profile of India. Disaster management cycle; Different stakeholder in disaster management; Disaster mitigation structure in India, Emergency plan.

Essential/recommended readings

Edward Bryant (2005). Natural Hazards. Cambridge University Press
Smith, Keith, (2013). Environmental hazards: assessing risk and reducing disaster: Routledge Taylor & Francis Group. London.

Suggestive readings

Edward Bryant (2005). Natural Hazards. Cambridge University Press
Smith, Keith, (2013). Environmental hazards: assessing risk and reducing disaster: Routledge Taylor & Francis Group. London.
Edward A. Keller; Duane E. DeVecchio (2014). Natural Hazards: Earth's Processes as Hazards, Disasters, and Catastrophes. Routledge.
Bell, F.G., 1999. Geological Hazards, Routledge, London.
David C. Alexander (1993). Natural Disasters. CRC Press

DISCIPLINE SPECIFIC CORE COURSE - DSC – 13: Economic Geology (L3, P1)

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)	No. of hours of Lectures	No. of hours of Tutorial	No. of hours of Practical	Total Hours of Teaching
		Lecture	Tutorial	Practical/ Practice						
DSC – 13: Economic Geology (L3, P1)	**4**	**3**	**0**	**1**	**Class XII pass with Science**	**Studied Earth System Science and Mineralogy or Equivalent at the UG level**				

Learning Objectives

Introducing students to morphology, structure, mineralogy, petrology and geochemistry of various ore deposits, and help them to develop a basic idea of different ore forming processes.

Learning outcomes

Basic characteristics and distribution of mineral resources and knowledge of different ore geological systems.

SYLLABUS OF DSC-7

UNIT – I (9 hours)

Detailed content

Introduction to ore geology: Economic and academic definitions/terminologies of ore geological components. Ore minerals and their uses. Morphology and style of ore mineralization. General textures and structures

UNIT – II (9 hours)

Detailed contents

Basic principles of an ore deposit formation: Geochemical behaviour of elements in ore geological systems. Concept of source-transporting agent-driving mechanism-trap

UNIT – III (9 hours)

Detailed contents

Ore forming processes: Magmatic ore forming processes. Hydrothermal ore forming processes. Sedimentary ore forming processes. Surficial and supergene ore forming processes

UNIT – IV (9 hours))
Detailed contents
Basic mineral economics

UNIT – V (9 hours)
Detailed contents
Distribution of major metallic and non-metallic ore deposits in India

Practical Component- (30 Hours)
Identification of common ore minerals by physical and optical properties

Essential/recommended readings
Robb, L., 2020. Introduction to ore-forming processes. John Wiley & Sons.

Evans, A.M., 2009. Ore geology and industrial minerals: an introduction. John Wiley & Sons

Suggestive readings
Robb, L., 2020. Introduction to ore-forming processes. John Wiley & Sons.
Evans, A.M., 2009. Ore geology and industrial minerals: an introduction. John Wiley & Sons.
Bateman, A.M. and Jensen, M.L. 1990. Economic Mineral Deposits. John Wiley & Sons.
Misra, K., 2012. Understanding mineral deposits. Springer Science & Business Media.
Ramdohr, P., 2013. The ore minerals and their intergrowths. Elsevier.
Sarkar, S.C. and Gupta, A., 2012. Crustal evolution and metallogeny in India. Cambridge University Press.

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.

DISCIPLINE SPECIFIC CORE COURSE – DSC – 14: Engineering Geology ((L3, P1)

Credit distribution, Eligibility and Prerequisites of the Course

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)	No. of hours of Lectures	No. of hours of Tutorial	No. of hours of Practical	Total Hours of Teaching
		Lecture	Tutorial	Practical/ Practice						
DSC – 14: Engineering Geology ((L3, P1)	**4**	**3**	**0**	**1**	**Class XII pass with Science**	**Studied Stratigraphy, Structural Geology or Equivalent at the UG level**				

Learning Objectives

This course provides a basic introduction on the role of geology in slope stability and civil engineering constructions such as dams, tunnels, roads etc. It is aimed to discuss the essential components of topography, lithology and geological structures to ensure the stability and economy of engineering projects. The course also introduces a systematic approach to planning and designing engineering structures.

Learning outcomes

After going through this course, students will have basic understanding the geological and geotechnical aspects of major engineering projects. They will know qualitative and quantitative properties of geological material like rock and soil. They will understand slope failure mechanism and their mitigation measures. They will realize the sSignificance of site investigation, survey methods and assessment of environmental impacts of any engineering project.

SYLLABUS OF DSC- 14

UNIT – I (9 hours)

Detailed contents

Introduction to engineering geology: Principles and scope of engineering geology: material, material fabrics and environmental factors. Geological and geotechnical investigations.

UNIT – II (9 hours)

Detailed contents

Engineering properties of geological material: Rock strength; Rock aggregates; Significance of rock as construction material; Rock mass: discontinuities, Rock mass classification; Soil: strength, standard penetration test and engineering bedrock.

UNIT – III (9 hours)

Detailed contents

Engineering structures: dams, tunnels and roads: Engineering structures: Dams, tunnels, road, their types, acting forces, ground conditions; tunnelling methods; geological considerations for site selection.

UNIT – IV (9 hours)

Detailed contents

Slope failure and mitigation measures: Concept of slope failure mechanism; Landslide types and causes, landslide mapping; Engineering treatment of slope and foundations: grouting, retaining walls, rock bolting and other support mechanisms.

UNIT – V (9 hours)

Detailed contents

Site investigation and assessment for engineering structures: Site investigation and characterization; Reconnaissance survey; Environment impact assessment (EIA); Detailed project report (DPR)

Practical Component- (30 Hours)

Merits, demerits & remedial measures based upon geological cross sections of project sites. Computation of Index properties of rocks and soil. Concept, significance and computation of Rock Mass Classification schemes like Rock Structure Rating (RSR), Rock Mass Rating (RMR)/ Tunnelling Quality Index (Q)/Rock Quality Designation (RQD).

Essential/recommended readings

Krynin, D.P. and Judd, W.R. (1957). Principles of Engineering Geology and Geotechnique, McGraw Hill (CBS Publ).

Gangopadhyay, S. (2013). Engineering geology. Oxford University Press.

Suggestive readings (if any)

Krynin, D.P. and Judd, W.R. (1957). Principles of Engineering Geology and Geotechnique, McGraw Hill (CBS Publ).

Gangopadhyay, S. (2013). Engineering geology. Oxford University Press.

Goodman, R.E. (1993). Engineering Geology: Rock in engineering constructions. John Wiley& Sons, N.Y.

Waltham, T. (2009). Foundations of Engineering Geology (3rd Edn.) Taylor & Francis.

Bell, F.G. (2007). Engineering Geology, Butterworth-Heinema.

Anbalagan, R. Singh, B, Chakraborthy, D. and Kohli, A. (2007) “A filed Manual for Landslide investigations”. DST, Government of India, New Delhi.

Duncan C. Wyllie and Christopher W. Mah. (2004). Rock Slope Engineering. CRC Press. London.

David George Price (2009). Engineering Geology: Principles and Practice. Springer-Verlag Berlin Heidelberg

DISCIPLINE SPECIFIC CORE COURSE– DSC – 15: Geological Mapping (L2, P2)

Credit distribution, Eligibility and Pre-requisites of the Course

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)	No. of hours of Lectures	No. of hours of Tutorial	No. of hours of Practical	Total Hours of Teaching
		Lecture	Tutorial	Practical/ Practice						
DSC – 15: Geological Mapping (L2, P2)	**4**	**2**	**0**	**2**	**Class XII pass with Science**	**Studied Structural Geology, Igneous/Metamorphic Petrology and Mineralogy or Equivalent at the UG level**				

Learning Objectives: To acquire basic skills of delineating the geological details of a terrain and produce a geological map, which is the starting point for any geological and/or mineral investigation.

Learning Outcomes:

Through this course, the students will learn the following essential knowledge and skills:

i) To identify a rock and broadly define its composition.

ii) To identify and measure lithological and/or structural details of rocks at the outcrop/hand-specimen scale.

iii) To plot the data on a base map/toposheet to create a lithological and/or structural map of the terrain.

iv) To appreciate the possible origin of the rock and their genetic process.

v) To reconstruct the geological history of the terrain.

SYLLABUS OF DSC-15

UNIT – I (6 hours)

- Introduction to toposheets: Concepts of scale, contour density, numbering system.
- Global Positioning Systems, their types and uses.
- Choosing a suitable geological traverse

UNIT – II (6 hours)

- Outcrop pattern of beds in a undulating topography – rule of V
- Identification of rock types, and their classification based on field criteria
- Textural features of different rocks through field study and microscopy

UNIT – III (6 hours)

- Basic concept of structural measurement – strike, dip, trend, plunge, pitch
- Distinguishing characters of planar and linear structures in the outcrop scale
- Overprinting nature of folds/ metamorphic foliations

UNIT – IV (6 hours)

- Identification and structural measurement of a fold in the field
- Geometric classification of a fold based on field data
- Understanding the outcrop pattern of a fold in non-ideal sections

UNIT – V (6 Hours)

- Distinguishing criteria of a fault in the field
- Understanding the slip pattern of faults in an outcrop
- Measuring the orientation of different planar and linear structures associated with a fault.

Practical Component- (60 Hours)

- In the practical class, all the aforesaid techniques of measurement and identification will be demonstrated and practised in the field.
- The practical classes of this course will be conducted at a go through field visit (4-5 days) in a suitable geological terrain

Essential/recommended readings

1) Lahee F. H. (1962): Field Geology. McGraw Hill

2) *Billings, M. P. (1987). Structural Geology, 4th edition, Prentice-Hall.*

Suggestive readings

1) *Davis, G. R. (1984) Structural Geology of Rocks and Region. John Wiley*
2) *Park, R. G. (2004) Foundations of Structural Geology. Chapman & Hall.*

Discipline Specific Elective (DSE-3): River Science (L3, P1)

Credit distribution, Eligibility and Pre-requisites of the Course

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)	No. of hours of Lectures	No. of hours of Tutorial	No. of hours of Practical	Total Hours of Teaching
		Lecture	Tutorial	Practical/ Practice						
DSE-3 River Science (L3, P1) **OR** **Introduction to Geophysics OR** **Paleoseismology: Concepts and Applications**	4	3	0	1	Class XII pass with Science	Studied Earth System Science, Sedimentary Geology and/or Equivalent at the UG level				

Learning Objectives

To understand the life cycle of a river especially in relation to societal development. To understand the process of erosion and transportation of sediments and its connection with the landforms

Learning outcomes

After going through this course, students will understand Rivers through geological time. They will know about fluvial degradational and aggradational processes. They can work with landforms associated with the rivers

SYLLABUS OF DSE-3

River Science (L3, P1)

UNIT – I (9 Hours)

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

UNIT – II (9 Hours)
River basin: Sediment source and catchment erosion processes; Sediment load and sediment Yield; Sediment transport processes in rivers; Erosion and sedimentation processes in channel.

UNIT – III (9 Hours)
Drainage: Drainage network; Quantitative analysis of network organization - morphometry Role of drainage network in flux transfer;
Evolution of drainage network in geological time scale.

UNIT – IV (9 Hours)
Rivers in time and space: River diversity in space, Patterns of alluvial rivers - braided, meandering and anabranching channels, Dynamics of alluvial rivers; Channel patterns in stratigraphic sequences;
Different classification approaches in fluvial geomorphology and its applications.

UNIT – V (9 Hours)
Channels and Landscapes: Bedrock channels, Bedrock incision process; River response to climate, tectonics and human disturbance; Bedrock channel processes and evolution of fluvial landscapes. Fluvial hazards: Integrated approach to stream management.
Introduction to river ecology.

Practical Component- (30 Hours)
Exercises based on River visit during weekend, Stream power calculation, Longitudinal profile analysis, Hydrograph analysis, and Flood Analysis

Essential/Recmmended readings
Fryirs and Brierly (2013) Geomorphology and river management. Wiley-Blackwell Pub.
Julien, P.Y. (2002) River Mechanics. Cambridge University Press.

Recommended readings
Fryirs and Brierly (2013) Geomorphology and river management. Wiley-Blackwell Pub.
Julien, P.Y. (2002) River Mechanics. Cambridge University Press.

OR

DSE-3: Introduction to Geophysics (L3, P1)

UNIT – I (9 Hours)
Interrelationship between geology and geophysics, Role of geology and geophysics in explaining geodynamical features of the earth.

UNIT – II (9 Hours)
General and Exploration geophysics: Different types of geophysical methods - gravity, magnetic, electrical and seismic; their principles and applications; Concepts and Usage of corrections in geophysical data

UNIT – III (9 Hours)
Geophysical field operations: Different types of surveys, grid and route surveys, profiling and sounding techniques; Scales of survey,

UNIT – IV (9 Hours)
Application of Geophysical methods. Regional geophysics, oil and gas geophysics, ore geophysics, groundwater geophysics, engineering geophysics, internal structure of the Earth based on major discontinuities in seismic velocities.

UNIT – V (9 Hours)
Geophysical anomalies: Correction to measured quantities, regional and residual (local) anomalies, factors controlling anomaly, and depth of exploration.
Integrated geophysical methods: Ambiguities in geophysical interpretation, planning and execution of geophysical surveys

Tutorials (30 Hours)

Calculating the free air and Bouguer anomalies.
Determining the gravity anomaly arising due to density contrast in the subsurface.
Calculating paleolatitude and paleopole.
Numerical problems on resistivity survey.
Problems on seismic survey.

Essential/Recommended readings

Kearey, P., Brooks, M. and Hill, I., 2002. *An Introduction to Geophysical Exploration* . Third Edition. Blackwell Publishing.
Lowrie, W. (2007). Fundamentals of geophysics. Cambridge University Press.
Mussett, A.E. and Khan, M.A., 2000. *Looking into the Earth: An Introduction to Geological Geophysics*. Cambridge University Press.
Bhimasankaram, V.L.S. (1990). Exploration Geophysics - An Outline by, Association of Exploration Geophysicists, Osmania University, Hyderabad.
Dobrin, M.B. (1984) An introduction to Geophysical Prospecting, McGraw-Hill, New Delhi.

Recommended readings

Bhimasankaram, V.L.S. (1990). Exploration Geophysics - An Outline by, Association of Exploration Geophysicists, Osmania University, Hyderabad.
Dobrin, M.B. (1984) An introduction to Geophysical Prospecting, McGraw-Hill, New Delhi.
Telford, W. M., Geldart, L. P., & Sheriff, R. E. (1990). Applied geophysics (Vol. 1), Cambridge University press.

*** Course content of Paleoseismology to be added.

One GE from GE pool (GE-4): Concepts of Sustainability (L4, P0)

Credit distribution, Eligibility and Pre-requisites of the Course GE-5

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)	No. of hours of Lectures	No. of hours of Tutorial	No. of hours of Practical	Total Hours of Teaching
		Lecture	Tutorial	Practical/ Practice						
GE-5 Concepts of Sustainability (L4, P0)	**4**	**3**	**1**	**0**	**Class XII pass with Science**	**Nil**	**60**	**0**	**0**	**60**

Learning Objectives

To explain the challenges of global sustainability to the students and motivate them to think about the solution to these challenges. Also, this course would encourage students to talk about sustainability with others to create awareness.

Learning outcomes

After completion of this course, students should be able to: understand major challenges and opportunities in the area of global sustainability. Understand the systems concept and interconnectivity of humans and nature. Communicate about sustainability. Critically analyse the problems and solutions related to global sustainability.

SYLLABUS OF GE-5

UNIT – I (15 Hours)

Detailed contents

Introduction to Sustainability; basic concepts Human Population – Past and Future trends; the ecological footprint; a resilient planet.
Introduction to Sustainable Development Goals.

UNIT – II (15 hours)

Detailed contents

Ecosystems: Ecosystem services; Extinctions and Tragedy of Commons; Water Resources; Sustainable Agriculture; Concept of minimalism.

UNIT – III (15 Hours)

Detailed contents

National Resources Accounting, Environmental Economics and Policy, Measuring Sustainability

UNIT – IV (15Hours)

Detailed contents

What is Geoscience? Role of geosciences in achieving Sustainable Development Goals; case studies. Systems interconnectivity among Primary Sustainability challenges Sustainability Solutions: Some examples

Essential/recommended readings

Rogers, P.P., K. F. Jalal, and J.A. Boyd. 2007. An Introduction to Sustainable Development. Earthscan Publishers, 416 pp.

Capello et al., 2023. Geoscience in Action: Advancing Sustainable Development. American Geophysical Union (pdf copy freely available).

Suggestive readings

Brown, L. 2009. Plan B 4.0. Norton Publishers, New York. (The entire book is available in pdf format: http://www.earthpolicy.org/images/uploads/book_files/pb4book.pdf)