DEPARTMENT OF GEOLOGY
SEMESTER – IV
BSC (H) Geology
Category - I

DISCIPLINE SPECIFIC CORE COURSE -10 (DSC-10) – : Geomorphology (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)
		Lecture	Tutorial	Practical/ Practice		
(DSC-10) **Geomorphology (L3, P1)**	**4**	**3**	**0**	**1**	**12th pass with science**	**Studied Earth System Science and Equivalent**

Learning Objectives

The course on geomorphology is intended to provide students basic scientific knowledge Earth surface process and evolution of the landforms. Students will be aught about the basic and fundamentals of geomorphology to comprehend the process and evolution of landscapes through time.

Learning outcomes

After going through this course, students will develop basic skills and understanding about the key concepts of geomorphology, i.e., systems (morphological, cascading, process-response), threshold, magnitude and frequency, unifying concepts such as conservation of mass and energy in geomorphic systems, sediment routing, equilibrium and steady state. They will be able to use the knowledge to identify various landforms and processes in different environments i.e., glacial, fluvial, aeolian, coastal regions. They will also be able to examine the landforms at primary scale. They will be able to analyse the morphometric parameters of a basin. They will develop skills to prepare a geomorphic map using topographic sheets and Google Earth images.

SYLLABUS OF DSC-10 (Credits: 4)
Theory: 45 hours, Practical: 30 hours

UNIT – I (9 hours)

Detailed content

Introduction to Geomorphology: Concepts in geomorphology, Geosphere-Hydrosphere-Biosphere; Unifying concepts

UNIT – II (9 hours)

Detailed contents

Morphological features of Earth: 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

Earth Surface Processes: 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

Methods and techniques: 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 : DSC-11- Hydrogeology (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)
		Lecture	Tutorial	Practical/ Practice		
(DSC-11) Hydrogeology (L3, P1)	4	3	0	1	12th Pass with Science	Studied Stratigraphy, Earth System Science or Equivalent

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

Learning Outcomes:
After completing the course, the students will get a basic understanding of aquifers and groundwater systems. The students will be able to comprehend the groundwater flow dynamics and well hydraulics, enhancing their numerical skills for development of groundwater resources. Learners will gain expertise in fundamentals of groundwater exploration helping them to identify groundwater sources in field. The students will be able to analyse and compare the groundwater quality. This would help them to categorise the use of groundwater for various purposes. Learners will be skilled with fundamentals of water balance, groundwater resource estimation and groundwater resource management practices.

SYLLABUS OF DSC- 11
Theory (45 Hours)

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.

Suggested readings

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 (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)
		Lecture	Tutorial	Practical/ Practice		
DSC-12 Geology of India (L3, P1)	4	3	0	1	12th Pass with Science	Studied Earth System Science, Concepts of Stratigraphy, Structural Geology, and Mineralogy or Equivalent

Learning Objectives

The course on Geology of India is to provide students a comprehensive understanding about the overall geology of the Indian subcontinent through stratigraphic approach. Students will be taught about the geological history of the Indian subcontinent spanning from Archean to Quaternary times. They will be motivated to learn the role of tectonics, climate and sea level in framing the geological history of India through time.

Learning Outcomes:

After completion of the course, students will have understanding of stratigraphic sub-divisions of India from Archaean to Cenozoic times. They will acquaint with depositional environments, paleogeographic setting and tectonic evolution of various Indian sedimentary basins and their fossils and mineral assets. They will understand the major mass extinction events, its effect on various faunas and their recovery after mass extinction.

SYLLABUS OF DSC-12
Theory (45 Hours)

UNIT – I (9 hours)
Detailed contents
Introduction to geology of India: Physical and tectonic subdivisions of Indian subcontinent

UNIT – II (9 hours)
Detailed contents
Major sub-divisions Indian Geology: Distribution of stratigraphic units in the Peninsula and in the Himalayas. Stratigraphy, geographic distribution, lithological characteristics, fossil contents and economic importance.

UNIT – III (9 hours)
Detailed contents
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.
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UNIT – IV (9 hours)
Detailed contents

Stratigraphic boundary problems: Precambrian-Cambrian boundary; Permian-Triassic boundary; Cretaceous-Tertiary boundary

UNIT – V (9 hours)

Glacial Events: Major 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.