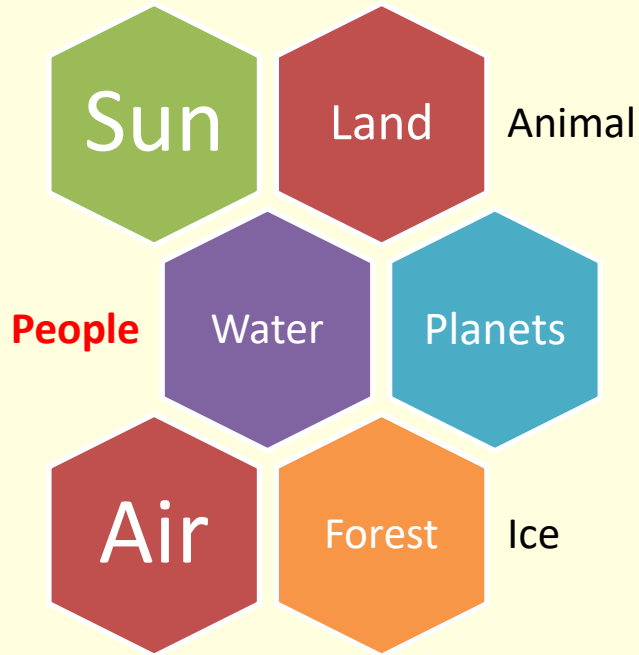


Introduction to Earth System Science



Course: Earth System Science
Programme Five Year Integrated M.Sc.,
Geography
Year: First Year | First Semester

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Professor and Head
Department of Geography
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Course : Earth System Science

Unit 1: Earth System Science: Nature – scope – branches of earth sciences – recent trends. origin of the Universe: Bing Bang Theory – galaxy, Solar System: Origin (*Nebular Hypothesis, Planetesimal Hypothesis, Jeans Tidal Theory, Jeffery Collision Hypothesis, Binary star theory*)- Cosmic abundance of elements Planets – inner planets – outer planets – Asteroids – meteoroids – comets – black hole.

Unit 2: Earth: Origin, , Primary differentiation - Interior of Earth: Crust – Mantle – Core, Isostasy: Airy's and Pratt's theories, magnetic field, temperature. Origin of atmosphere – ocean – life. size, shape, rotation - revolution – latitude – longitude – time zone

Unit 3: Mountain Building: Introduction to orogeny, orogenic cycles, epeirogeny –Cymatogenic movements - Geosyncline Theory - geosyncline types - Mountains: types and, important mountain belts of the world and India

Unit 4: Earthquake and Volcano: Earthquake: Causes and effects - seismic waves – distribution of earthquake, Volcanoes and volcanism, types and distribution of volcanoes - Tsunamis - World distribution.

Unit 5: The Dynamic Planet: Continental drift - Wegener's continental drift theory - Palaeomagnetism - Sea floor spreading - Plates and plate motion - driving forces of plate motion - Oceanic current system - Coriolis force.

Course Objectives

- ✓ Develop an understanding of Earth System Science and the scientific explanations for the origin and evolution of the Universe, Solar System, and Earth.
- ✓ Gain knowledge of the Earth's structure, composition, and physical properties, including its interior, atmosphere, oceans, and life-supporting systems.
- ✓ Explore the processes responsible for mountain building and crustal deformation and understand the formation of major landforms on Earth.
- ✓ Learn about geological hazards such as earthquakes, volcanoes, and tsunamis, including their causes, characteristics, and global distribution.
- ✓ Understand the dynamic nature of the Earth through the study of continental drift, plate tectonics, ocean currents, and related geodynamic processes

Course Outcome

- ✓ **CO1 Recall** the fundamental concepts of Earth System Science, the origin and evolution of the Universe, Solar System, and Earth, including major geological features and processes.
- ✓ **CO2 Explain** the structure, composition, and physical characteristics of the Earth, including its interior, atmosphere, oceans, magnetic field, and geodynamic processes.
- ✓ **CO3 Apply** Earth science concepts and theories to interpret mountain-building processes, crustal movements, and the formation of major landforms.
- ✓ **CO4 Analyze** the causes, mechanisms, distribution, and impacts of earthquakes, volcanoes, and tsunamis using geoscientific principles.
- ✓ **CO5 Evaluate** the evidence supporting continental drift, sea-floor spreading, plate tectonics, and related processes in explaining the dynamic nature of the Earth.

The word "geography" comes from **Greek**: geo ("earth") + graphia ("to write/describe") – literally meaning "to describe the earth."

The **FIRST** recorded use of the word geography was by **Eratosthenes**, a **Greek scholar** who lived from **276–194 BC** who is credited with creating the discipline of geography (Eratosthenes' Geography)

The concept maps specific geographical settings in **தொல்காப்பியம்** Tolkāppiyam
Kurinji (Mountainous region) | **Mullai** (Forest / Pastoral region) |
Marutham (Agricultural plains) **Neythal** (Seashore) | **Palai** (Arid / Desert region)
3rd century BCE and the 5th century CE | Tolkappiyar

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GEOGRAPHY

Physical Geography



Human Geography

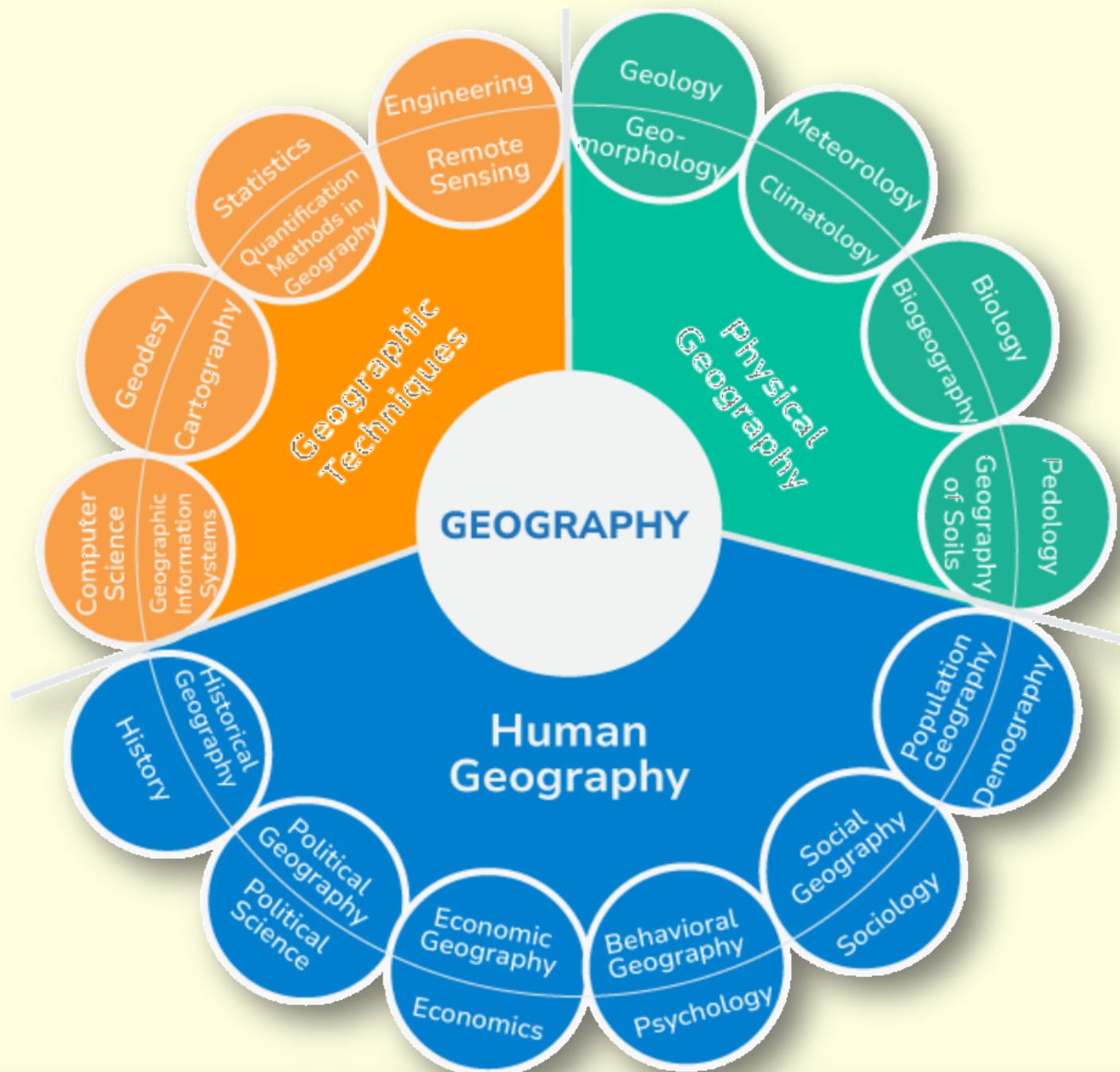


GEOGRAPHY

What is geography? Geography is, in the broadest sense, an education for life and for living. It is unique in bridging the social and natural sciences, and essential in understanding the world in which we live.

Geography informs us:

- ❖ The places and communities in which we live and work Our natural environments and the pressures they face
- ❖ The interconnectedness of the world and our communities within it How and why the world is changing, both globally and locally
- ❖ How our individual and societal actions contribute to those changes
- ❖ The choices that exist in managing our world for the future
- ❖ The importance of location in business and decision-making



BRANCHES OF PHYSICAL GEOGRAPHY



Geomorphology



Study of landforms and the processes that shape the Earth's surface.



Climatology



Study of climate, its variations and the controlling atmospheric processes.



Meteorology



Study of weather and atmospheric phenomena in the short term.



Hydrology



Study of water on, above and below the Earth's surface and its distribution, movement and properties.



Oceanography



Study of oceans, seas and marine environments including their physical, chemical and biological aspects.



Biogeography



Study of the geographical distribution of living organisms and the factors influencing it.



Pedology



Study of soils, their formation, classification, distribution and properties.



Glaciology



Study of glaciers, snow, ice sheets, icebergs and related landforms and processes.



Fluvial Geography



Study of rivers, streams, drainage basins and the fluvial processes.



Coastal Geography



Study of coastal environments, shoreline processes, coastal landforms and human-coast interactions.



Limnology



Study of inland water bodies such as lakes, ponds, wetlands and their physical and biological characteristics.



Bioclimatology



Study of the relationship between climate and living organisms.

★ These branches help us understand the natural components, processes and functioning of the Earth's environment.

BRANCHES OF HUMAN GEOGRAPHY



1. Population Geography



Study of population distribution, density, composition, growth, migration and other demographic characteristics.



2. Settlement Geography



Study of human settlements, their origin, pattern, distribution, classification and development.



3. Economic Geography



Study of economic activities of people such as agriculture, industry, trade, transport, services and their spatial organization.



4. Cultural Geography



Study of culture, language, religion, beliefs, customs, traditions and their geographical distribution and influence.



5. Political Geography



Study of political boundaries, states, nations, geopolitics, political behavior and international relations.



6. Social Geography



Study of social groups, social structure, social issues (inequality, poverty, welfare) and quality of life.



7. Urban Geography



Study of cities, urbanization, urban land use, urban problems, planning and management.



8. Rural Geography



Study of rural settlements, agriculture, rural economy, rural development and rural life.



9. Historical Geography



Study of the evolution of places, landscapes and human activities over time.



10. Medical (Health) Geography



Study of spatial distribution of diseases, health services, health problems and health behavior.



11. Behavioral Geography



Study of human perceptions, attitudes, decision-making and spatial behavior.



12. Transport Geography



Study of transport systems, networks, routes, terminals and their spatial impact on human activities.



13. Tourism Geography



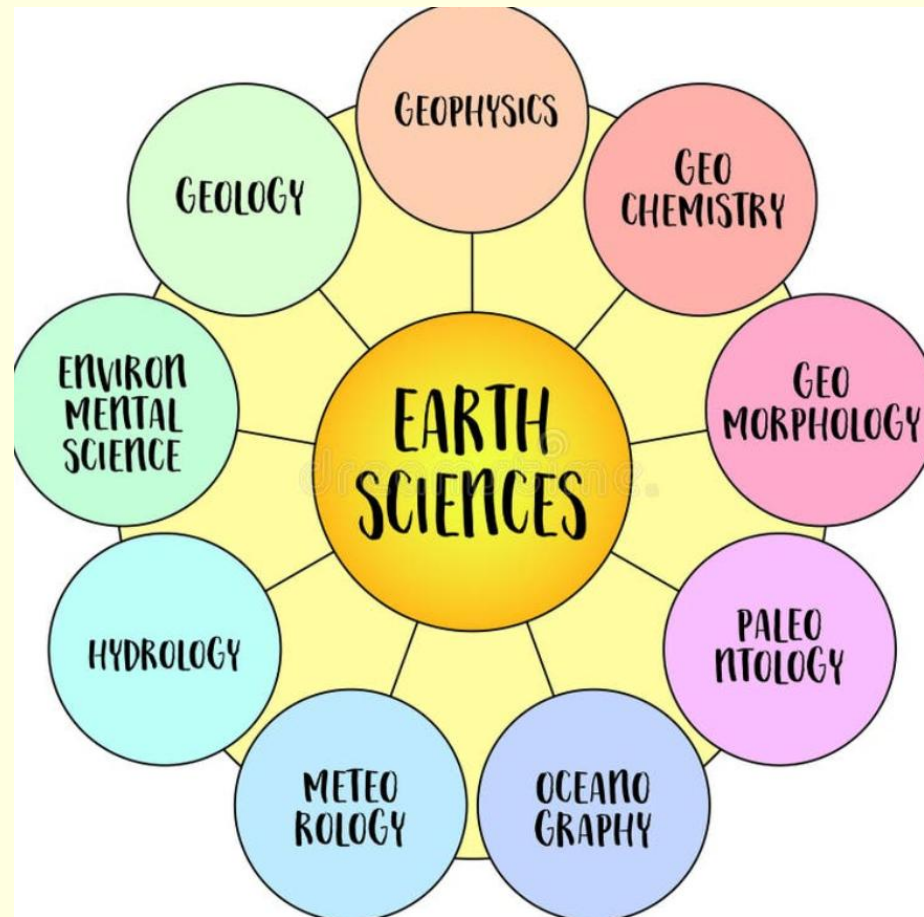
Study of tourism activities, tourist movements, tourist regions and their economic, social and environmental impact.



These branches help us understand how humans live, work, organize, interact and shape the Earth's surface across different places and regions.

HUMAN GEOGRAPHY — PEOPLE, PLACES & SPACES

What is Earth Sciences ? Earth Sciences is the broad field of study focused on understanding planet Earth — its structure, composition, processes, and history, as well as its interactions with the atmosphere, oceans, and living things



Scope Earth System Science

Earth System Science (ESS) examines the Earth as an integrated, complex entity. Its scope includes the chemical, physical, and biological interactions between Earth's spheres—the lithosphere, hydrosphere, cryosphere, atmosphere, and biosphere—and how human activity alters these systems. It is a holistic, interdisciplinary field

Core Domain of ESS

Atmosphere & Climate: Examining gases, weather, and climate systems. A primary focus is tracking and combating climate change through global observations.

Geosphere & Lithosphere: The solid earth, encompassing rocks, soil, tectonic plates, and planetary interiors.

Hydrosphere & Cryosphere: The study of all water bodies (oceans, groundwater) and frozen regions (glaciers, sea ice), driven by solar energy in the water cycle.

Biosphere & Pedosphere: All living organisms, ecological networks, and soil development, alongside the continuous cycling of matter and energy.

Anthroposphere: The study of human interactions, energy and food security, and societal impacts on natural environments

Solar Energy

Geosphere

Biosphere

Atmosphere

Lithosphere

Cryosphere

Hydrosphere

