

Course Type	Course Code	Name of Course	L	T	P	Credit
ESC	NGLE102	<b>Introduction to Oceanography and Climatology</b>	3	0	0	3

### Course Objective

This course provides a foundational understanding of the ocean and its interaction with the Earth's climate system.

### Learning Outcomes

Upon completion of the course, students will be able to:

1. Understand the basic physical, chemical, and biological properties of the ocean.
2. Describe the major oceanographic features and processes, including currents, waves, tides, and marine ecosystems.
3. Understand the fundamental concepts of climatology, including atmospheric circulation, energy transfer, and climate change.
4. Explore the linkages between oceanography and climatology, and their influence on Earth's systems.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1.	Introduction: Exploring Earth's "Blue Planet"; Oceans and their Importance; Basic oceanographic features and concepts: salinity, temperature, density, and thermocline; Introduction to Climatology: Weather vs. climate; climate elements.	4	Learn the significance of Earth's oceans, and distinguish between weather and climate.
2.	Exploring Oceans and Their Properties: Methods for oceanic research: Ships, buoys, and satellites; The ocean floor: topography, bathymetry, and geological features; The chemical composition (major, minor) and physical characteristics (Light penetration, heat capacity, and density changes) of seawater.	5	Understand oceanrelated research methodologies and seawater's properties for comprehensive oceanic analysis.
3.	Oceanic Dynamics: Ocean circulation: surface currents, subsurface currents, deep currents, and thermohaline circulation. Waves: Generation, classification, and impact on coastlines; Tides: gravitational forces, types and coastal processes.	7	Comprehend and analyze the complex interplay in oceans, and their impacts on coastal processes.
4.	Marine Ecosystem: Plankton, Nekton, Benthos, and Food Webs; Fisheries and Marine Resource Management: Sustainability and Environmental Concerns; Ocean pollution: types, origins, and effects on marine ecosystems. Estuaries and Coastal Ecosystems: Unique ecosystems at the land-sea interface.	4	Learn about marine ecosystems, fisheries management, ocean pollution, and the importance of estuaries.

5.	Introduction to Climatology: The atmosphere's composition: Layers, and energy balance; General atmospheric circulation: global wind patterns, precipitation, and pressure systems; Weather	8	Comprehend atmospheric composition, global wind patterns, weather
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	systems: fronts, cyclones, anticyclones, and precipitation. Monsoon systems; Climate variability and change: Natural and human-caused influences.		systems, and climate variability.
6.	Ocean-Atmosphere Interactions: Ocean acidification: Chemical effects of CO <sub>2</sub> absorption. Climate Change and Sea Level Rise: Threats and Responses. Global heat transport: the significance of oceans in climate regulation; El Niño-Southern Oscillation (ENSO) impacts and climate patterns.	8	Understand the oceanatmosphere interactions, climate change effects, and teleconnections.
7.	Applications and Future Challenges: Oceanography and Climate in Resource Management: Fisheries, Oil and Gas, and Climate Prediction; Remote sensing and data analysis for oceanography and climatology; Future challenges in a changing environment: Ocean Health, Sustainability, and Mitigation Strategies. AI and machine learning applications. Ocean Exploration and Climate Studies.	6	Acquire knowledge and critical thinking skills to solve real-world problems.
	<b>Total Classes</b>	<b>42</b>	

**Textbook: 1.** Pinet, P. (2009), *Invitation to Oceanography*, Jones & Bartlett Learning.

**Reference Books:**

- Society, A. M., Segar, D., Kish, S. and Mills, E. (2011), *Ocean Studies: Introduction to Oceanography*, American Meteorological Society, Education Program.
- Stewart, R. (2014), *Introduction to Physical Oceanography*, CreateSpace Independent Publishing Platform.
- Trujillo, A. and Thurman, H. (2019), *Essentials of Oceanography*, Pearson Education.
- Maul, G. (2012), *Introduction to satellite oceanography*, Springer Netherlands.
- Rohli, R. and Vega, A. (2017), *Climatology*, Jones & Bartlett Learning.
- Aguado, E. and Burt, J. (2015), *Understanding Weather and Climate*, Pearson.
- Garrison, T. and Ellis, R. (2021), *Oceanography: An Invitation to Marine Science*, Cengage Learning.