Atmospheric and Ocean Sciences

1.1. Course Number: GE 315

1.2. Contact Hours: 3-0-0 Credits: 9

1.3. Semester Offered: 3rd Year-Even

1.4. Prerequisite: Basic knowledge of Mathematics, Physics, Chemistry and Geology

1.5. Syllabus Committee Members: Dr. Alok Kumar Singh & Dr. Hemant Kumar Singh

2. **Objective:** The primary goal is to understand the basic principles that control our weather and the interactions between atmosphere and ocean that regulate Earth's climate.

3. **Course Content:** Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-topics	Lectures
1	Fundamental of Meteorology	Fundamental of Meteorology, Thermal Structure of the Atmosphere and its Composition, Evaporation, Condensation, Fog, Cloud and Precipitation, Thunderstorm.	6
2	Thermodynamics and Radiation	**Thermodynamics:** Thermodynamic principles, properties of dry and moist air, adiabatic processes, hydrostatic stability and instability, **Radiation:** Solar and terrestrial radiation, definitions, laws of radiation, albedo, greenhouse effect, heat balance of the earth and its atmosphere.	6
3	Wind System and General Circulation of Atmosphere	Geostrophic wind, Gradient wind, Thermal wind, Cyclostrophic wind and inertial wind, land and sea breezes, mountain, and valley winds, Condensation, precipitation, air masses, front, jet stream, extratropical and tropical cyclones, western disturbances, anticyclone, tornado, General Circulation of the Atmosphere.	7
4	Basics of Climatology	Concept of weather and climate, climatic elements, climatic factors, Earth-Sun relationship, ecliptic and equatorial plane, rotation and revolution of the earth, equinox, solstice, perihelion, cause of seasons, World distribution of insolation and air temperature and effects of land, sea and ocean current on it, diurnal and annual variation of surface air temperature at different latitudes, Principal seasons of India, , Cyclone and Anticyclone, and associated weather, fog, hail, thunderstorms, cold waves, subtropical westerly jet stream.	8

5	Physical Oceanography	***Physical Properties of Sea Water***: Chlorinity, salinity, thermal properties, density, pressure, optical properties, transmission of sound, water masses, T-S diagram, variation of salinity, heat budget of the ocean, Bowen ratio.	5
6	Ocean Currents, Waves and Tides	***Ocean Currents:*** Hydrodynamic equations of motion, inertia currents, geostrophic currents in homogeneous and stratified ocean; relative and slope currents, thermohaline currents, drift current in homogeneous water, Ekman theory, the major surface current systems of the ocean, upwelling and sinking with special reference to Indian Ocean and their effects; ***Waves:*** Wave celerity, group velocity, theory of surface gravity waves, short and long waves, generation and growth of wind wave; ***Tides:*** Tide generating forces, principal harmonic components, theories of tides, description and types of tides, prediction of tides, tidal gauges.	8
		Total	**40**

4. Readings:

4.1. Textbook:

- Introductory Oceanography by Harold V. Thurman, Mt. San Antonio College, Charles E. Merrill Publishing Company.
- Duxbury: The Earth and its Oceans
- McLellan: Elements of Physical Oceanography
- Oceanography for Beginners, by Pranab K. Banerjee, Allied Publishers Pvt. Limited

4.2. Reference Books:

- Johnson: Physical Meteorology
- Dobson: Exploring the Atmosphere
- Coastal Hydraulics, by A. M. Muir and C. A. Fleming 1981, The MacMillan Press Ltd, London.

5. Outcome of the course:

Following are the course outcomes:

- Students will be able to know the basic principles that control our weather and the interactions between atmosphere and ocean that regulate Earth's climate

- Students will learn how the oceans are connected to and drive major Earth processes, such as atmospheric and oceanic circulation, climate and weather, plate tectonics, and sustainability of human and marine populations.
- Students will be able to analyze atmospheric and oceanic circulation systems as well as their interconnections and driving forces.
- Students will be able to understand the physical processes which act on the ocean's surface and to recognize the submarine forms, the seawater composition, and properties.