

## **Add on course by Dr. Bitap Raj Kalita and Binita Pathak**

**Course Title: Weather Analysis**

**Nature of the Course: Add on**

**Total Credit assigned: 2**

**Credit distribution: T-1, P-1**

**Total Marks: 30 (T-15, P-15)**

### **Course Description**

This course offers a comprehensive introduction to Earth's atmosphere, and the mechanisms governing atmospheric processes. Students will explore the distinction between weather and climate, and gain insight into various weather parameters such as wind speed, temperature, humidity, and precipitation patterns etc. Additionally, the course delves into atmospheric circulation patterns, including factors influencing wind behaviour and phenomena such as monsoons, westerlies, and El Niño-La Niña events. Furthermore, students will learn about weather data handling techniques, including the use of ground-based and remote sensing instruments used for weather observations, and forecasting methods utilizing numerical models and surface charts. Through practical applications and theoretical exploration, students will understand the basics weather data and forecasting methodologies.

### **Course Objectives:**

- Understand the structure and composition of Earth's atmosphere as well as those of other planets.
- Acquire foundational knowledge on weather, climate, and other pertinent aspects of atmospheric science.
- Learn about weather parameters and the techniques used to measure them.
- Develop an understanding of weather forecasting methodologies.
- Identify different types of weather phenomena such as thunderstorms, tornadoes, cyclones, typhoons, El Niño, and La Niña etc.
- Analyze ground-based and remote sensing weather data

### **Learning Outcome:**

A learner will be able to

- Illustrate the diverse atmospheric phenomena and their evolutionary processes.
- Employ weather parameters to elucidate observations in fields such as Atmospheric Physics, Life Sciences, and Environmental Science.
- Utilize the principles of Physics to elucidate atmospheric phenomena.
- Analyse and interpret weather data
- Engage in interdisciplinary research opportunities within the realm of atmospheric science.

## **Course Content**

### **Unit I: Introduction**

Introduction to Earth's Atmosphere: structure and composition, weathersphere, heating of the Earth's atmosphere, temperature controls, Weather: Definition, difference between weather and climate, overview of weather parameters-wind speed and direction, temperature, humidity, pressure, solar radiation, rainfall, world climate systems, Clouds and precipitation: Formation mechanism, classification of Clouds, forms and mechanism of Precipitation

Atmospheric circulation-scales of atmospheric motion, factors affecting wind- pressure gradient force, Coriolis force, Friction, general circulation of the atmosphere, monsoons, westerlies, El Nino-La Nina,

Thunderstorms and tornados: types and formation mechanism, weather patterns: cyclone, typhoon, tornados

### **Unit II: Weather data handling**

Weather data sources: Ground based and remote sensing instruments: Automatic Weather Station, Radiosonde, Weather satellites, Radars, Models, meteorological convention, graphical representation of the weather parameters using tools like Matlab, Python, Google earth engine

Weather observations, weather maps, weather forecasting: importance, tools and methods, numerical weather prediction, time range of forecasts, weather forecasting using surface charts,

### **Suggested Readings:**

1. Meteorology for Scientists and Engineers, R Stull, Brooks/Cole, Thomson Learning
2. The Atmosphere: An Introduction to Meteorology, Frederick K. Lutgens, Edward J. Tarbuck, Illustrated by Dennis Tasa, PHI Learning Private Limited, Delhi
3. Basics of Atmospheric Science, A Chandrasekar, PHI Learning Private Limited, Delhi
4. Meteorology Today: An Introduction to Weather, Climate, and the Environment, C. Donald Ahrens, Cengage Learning
5. Environmental Meteorology, B PadmanabhaMurty, I.K. International Publishing House Pvt. Ltd., Delhi
6. The Physics of Atmospheres, J Houghton, Cambridge University Press
7. Essentials of Meteorology, An invitation to the Atmosphere, C D Ahrens and R Henson, Cengage Learning