# RARITAN VALLEY COMMUNITY COLLEGE
# ACADEMIC COURSE OUTLINE

## PHYS 125 - Introduction to Meteorology

### I. Basic Course Information

A. Course Number and Title: PHYS 125 - Introduction To Meteorology

B. New or Modified Course: Modified

C. Date of Proposal: Semester: Fall Year: 2020

D. Effective Term: Fall 2021

E. Sponsoring Department: Science & Engineering

F. Semester Credit Hours: 4

G. Weekly Contact Hours: 6
Lecture: 3
Laboratory: 3
Out of class student work per week: 7.5

H. Prerequisite: MATH 030 – Intermediate Algebra

I. Laboratory Fees: NO

J. Name and Telephone Number or E-Mail Address of Department Chair and Divisional Dean at time of approval:
Department Chair: Ed Carr, Edward.Carr@raritanval.edu
Divisional Dean: Sarah Imbriglio, sarah.imbriglio@raritanval.edu

### II. Catalog Description

Prerequisite: MATH 030 – Intermediate Algebra.

This course provides a survey of the fundamentals of meteorology, including the history, basic physical laws, local and global processes, instrumentation used, and general forecasting technology. Current or recent significant weather events will be included in lectures and labs. Through these elements, students will develop a greater understanding and appreciation of the behavior of the atmosphere.

## III. Statement of Course Need

**A.** Meteorology is specifically listed as a potential GE course by NJCC as long as it is physics based, and would provide an opportunity for students interested in weather to pursue this interest. With an expanded RVCC interest in green technologies and impact of man on the Earth, meteorology provides students with a way to understand atmospheric flows, how events in one part of the world (e.g. volcanism) can affect weather in far-reaching portions of the globe, effects of pollution, etc. This course may also have particular interest to Communication students interested in broadcast meteorology, students involved in environmental studies and engineering (construction with knowledge of environmental impacts and effects of weather on structures).

**B.** Through laboratory exercises, students will better understand how meteorology relates to everyday life, including the processes involved with storms, fronts, motions of air masses and even the general weather forecasts seen in the media.

**C.** This course generally transfers as a free elective and it is anticipated to transfer as a lab science general education course.

## IV. Place of Course in College Curriculum

A. Free Elective

B. This course serves as a General Education course in Science with Lab.

C. To see course transferability: a) for New Jersey schools, go to the NJ Transfer website, www.njtransfer.org; b) for all other colleges and universities, go to the individual websites.

## V. Outline of Course Content

A. Introduction to the atmosphere
   1. Meteorology, weather and climate
   2. Scientific inquiry/methods
   3. Structure of the atmosphere
   4. Earth as a planet
   5. Earth-Sun relationship / Energy

B. Temperature, Moisture, and Atmospheric Stability
   1. Temperature controls
   2. Measurement and scales
   3. Uses of data collected

C. Movement of Water Through The Atmosphere
    1. States of water
    2. Vapor Pressure, humidity and Dew Point
    3. Adiabatic cooling and condensation
    4. Lifting of air/moisture
    5. Changes in stability

D. Condensation and Precipitation
    1. Cloud formation and types
    2. Dew and Frost
    3. Formation of precipitation and types
    4. Measurement
    5. Intentional Weather Modification

E. Air Pressure, Winds and Global Circulation
    1. Measuring air pressure
    2. Horizontal variations
    3. Pressure Gradient Force, Coriolis Force, Friction
    4. Winds aloft
    5. Large and small scale movement and circulation
    6. Distribution of pressure and winds
    7. Jet streams
    8. Ocean currents
    9. Zonal distributions

F. Air Masses
    1. Air masses and source regions
    2. Classification
    3. Changes / modification
    4. Properties of North American air masses

G. Weather Patterns
    1. Fronts
    2. Mid-Latitude Cyclone
    3. Traveling Cyclones
    4. Anticyclonic weather and blocking highs
    5. Conveyor belt model

H. Local Severe Weather
    1. Thunderstorms and types
    2. Severe thunderstorms/supercells
    3. Lightning and thunder
    4. Tornadoes and how they develop
    5. Forecasting local/small scale severe weather events

I. Large Scale Severe Weather
   1. Hurricane formation and decay
   2. Intensity and destruction
   3. Detection and tracking

J. Storm Chasers
   1. Safety concerns
   2. Media sensationalism
   3. Value of information gathered

K. Weather Analysis and Forecasting
   1. Weather as a business
   2. Gathering data (NOAA/NWS)
   3. Numerical (computer) and other forecasting techniques
   4. Upper level and surface level conditions
   5. Long range forecasting
   6. Accuracy
   7. Uses of satellites

L. Modern Meteorological Tools
   1. Human observations
   2. Doppler Radar
   3. Dynamic (animated) maps from numerical predictions
   4. Sources of information on the internet

M. Climate
   1. Types of climates
   2. Natural causes of climate change
   3. Human impact on climate
   4. Global warming

N. Atmospheric Optics
   1. Refraction and reflection of light
   2. Mirages
   3. Halos, Sun dogs (and moon dogs), Solar Pillars
   4. Upper atmospheric clouds - Noctilucent clouds
   5. Air pollution

## VI. General Education and Course Learning Outcomes

### A. General Education Learning Outcomes:

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

1. Demonstrate proper use of the scientific method to analyze weather problems, and draw conclusions from data and evidence (GE-NJ 2, 3).
2. Demonstrate how to access meteorological information freely available on the internet and how to use it in their daily lives (GE-NJ 4, IL).
3. Describe how people and population centers influence weather (GE-NJ 5).

### B. Course Learning Outcomes:

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

1. Describe the Earth-Sun relationship and how it relates directly to daily weather and seasonal and climatic changes.
2. Describe the layers of the atmosphere and how they relate to weather and other atmospheric phenomena, including clouds and types of precipitation.
3. Demonstrate proper use of meteorological instruments, and explain what they measure and how they are used to make a forecast.
4. Demonstrate proper use of the scales (English, metric) used to measure weather and explain how they are different. *
5. Describe how modern technology, such as automated weather stations, doppler radar and satellites is used in meteorology.
6. Describe small and large scale air masses, and explain how they are classified and how they move.
7. Explain how to protect life and property when severe storm conditions occur. *
8. Demonstrate how a wealth of meteorological information is freely available on the internet and how to use it in their daily lives.
9. Explain how the "human element" is still used daily and is invaluable in collecting the data used in weather, including "storm chasers". *
10. Explain about how people and population centers influence weather. (i.e. The "heat island effect" of cities.) *

(* Embedded critical thinking.)

### C. Assessment Instruments:

A. Homework assignments (required)
B. Labs (required)
C. Quizzes
D. Tests (required)
E. Exams (required)
F. Presentations

## VII. Grade Determinants

A. Quizzes
B. HW assignments
C. Labs (required)
D. Midterm / Final Exams (required)
E. Optional presentation

Primary formats, modes, and methods for teaching and learning that may be used in the course:

A. lecture/discussion
B. small-group work
C. computer-assisted instruction
D. guest speakers
E. laboratory
F. student oral presentations
G. independent study

## VIII. Texts and Materials

A. Suggested Textbook: "The Atmosphere" by Frederick Lutgens and Edward Tarbuck
B. Suggested Lab Manual: "Weather and Climate" by Greg Carbone
C. Online materials supplied with the textbook.
D. Current events in weather. (Online information and news.)
E. Use of free NOAA/National Weather Service data.

Please Note: The course outline is intended only as a guide to course content and resources. Do not purchase textbooks based on this outline. The RVCC Bookstore is the sole resource for the most up-to-date information about textbooks.

## IX. Resources

A. Library for researching additional information.
B. Planetarium will aid in some visualizations.
C. Online materials.

**X. Honors Options:** None