Miami-Dade Community College
Met 1010 – Introduction to Weather

Course Description: An introduction to the fundamentals of weather and their impact on human activities. Topics include temperature, humidity, clouds, precipitation, air masses, fronts and storms. Emphasis in on understanding how these processes take place and their results.
3 Credits
Prerequisites and Co-requisites: None
Recommended: MET 1010L

Course Competencies:

Competency 1: The Student will learn about the structure of the Earth's Atmosphere and some of the terms used to describe it.
The student will be able to:

a. Define the terms such as water vapor, radiosonde, aerosols, weather, pollutants, weather elements, wind, outgassing, inversion, climate, wind direction, air pressure.
b. List the 4 major gases making up the Earth's lower atmosphere.
c. Explain how the Earth's atmosphere "protects" things at the Earth's surface.
d. Draw and label the four layers of the Earth's atmosphere.
e. Compare and contrast weather and climate.
f. Describe several ways weather and climate influence the lives of people.
g. List the common weather elements.
h. Discuss the role of CFC's in the destruction of the ozone layer in the stratosphere.
i. Explain how scientists believe the ozone hole forms over Antarctica.
j. Rank storms in size from smallest to largest.
k. Discuss how water influences the Earth's atmosphere.
l. Explain why air pressure always decreases with increasing altitude.
m. List several of the aerosols found in the Earth's atmosphere.
n. Describe what is meant when a weather person tells the wind direction.

Competency 2: The Student will learn specific terms and concepts concerning the warming of the Earth and its atmosphere.
The student will be able to:

a. Define terms relating to the temperature of the Earth and the movement of heat such as kinetic energy, temperature, greenhouse effect, heat, latent heat, radiant energy, electromagnetic waves, photons, black body, radiative equilibrium, selective absorbers, atmospheric windows, albedo.
b. Distinguish between heat and temperature.
c. Explain how heat is transferred in the Earth's atmosphere by conduction, convection, radiation, advection.
d. Discuss the concept of latent heat and why it is an important source of heat for the Earth's atmosphere.
e. Describe how the amount of radiation emitted by the Earth compares with that emitted by the sun.

f. Contrast and compare a greenhouse and the Earth's atmosphere.

g. List several gases that are involved in the Earth's natural green house effect.
h. Discuss why the Earth's albedo is 30%.
i. Explain how the atmosphere near the Earth's surface is heated from below.
j. Draw and label a sketch of the seasons as seen from space. Include the sun and the four positions of the Earth on the first day of each of the seasons.
k. List the main factors that determine seasonal temperature variations on Earth.
l. Explain why more northerly latitudes are cooler than more southerly latitudes during the Northern Hemisphere's summer even though there are more hours of daylight at the more northerly latitudes.
m. Discuss why summers in the Northern Hemisphere of the Earth are warmer than winters even tough the Earth is actually 4 million miles closer to the sun in winter.
n. Describe why vegetation on the north side of a hill is usually different from that on the south side of the same hill.
o. Convert among the types of temperature scales: Kelvin, Fahrenheit and Celsius.

Competency 3: The Student will learn specific terms and concepts about air temperature.
The student will be able to:
a. Define terms such as radiational cooling, inversion, thermal belt, orchard heater, wind machine, specific heat, wind chill factor, hypothermia, radiometer, thermometer, thermograph, and instrument shelter.
b. Explain how incoming energy and outgoing energy regulate the daily variation in the air temperature.
c. List several sod the measures farmers use to protect their crops against the cold and explain the physical principle behind each.
d. Describe each of the controls of the temperature.
e. Explain how radiational cooling produces a radiation temperature in version.
f. Discuss how thermometers measure air temperature.
g. Discuss the atmospheric conditions that can produce hypothermia.
h. Explain why the daily range of temperature is normally greater (1) in dry regions than in humid regions, and (2) on clear days than on cloudy days.
i. Briefly discuss the concept of thermal belts.
j. Draw a vertical profile on temperature from the ground to an elevation of 3 meters (10 feet) on a clear, windless (1) afternoon, (2) early morning just before sunrise. Explain why the two curves are different.
k. Explain why the lower braches of trees are more susceptible to damage from low temperatures.
l. Discuss why the first freeze in the fall and the last freeze in the spring occur in low lying regions.
m. Explain why the largest annual range in temperature is normally observed over continents away from large bodies of water.
n. When given a wind chill equivalent table, determine the wind chill equivalent temperature if the wind is blow 30 mph and the air temperature is 20 degrees F.

Competency 4: The Student will learn specific terms and concepts about humidity, condensation and clouds.
The student will be able to:

a. Define terms relating to cloud formation such as condensation, precipitation, hydrologic cycle, saturation, condensation nuclei, humidity, vapor pressure, relative humidity, psychrometer, hygrometer, dew, haze, fog, contrail, frost.
b. Trace the movement of water in the hydrologic cycle.
c. Draw sketches of the (9) major cloud types.
d. Match the characteristic to the type of cloud that shows them.
e. Explain how dew, frost, frozen dew and visible frost form.
f. List several examples of condensation nuclei and explain why they are significant in the atmosphere.
g. Describe how you can obtain both the dew point and the relative humidity using the sling psychrometer.
h. Give the two primary ways fogs ways fog forms.
i. Discuss relative humidity and how it relates to temperature.
j. Explain why the wet buld temperature is god measure of how cool human skin can become.

Competency 5: The Student will learn specific terms and achieve specific knowledge about the development of clouds and precipitation.
The student will be able to:

a. Define terms such as: adiabatic process, dry adiabatic lapse rate, environmental lapse rate, lifting condensation level, conditional instability, orographic lifting, rain shadow, capture-coalescence process, supercooled, ice nuclei, ice crystal process, accretion, cloud seeding, rain, drizzle, virga, rain shower, snow, fall streaks, snow flurries, snow squall, blizzard, sleet, freezing rain, snow grains, snow pellets, hailstones, standard rain gage, trace of precipitation, water equivalent, radar.
b. Explain why the dry adiabatic lapse rate and the wet rate are different.
c. Discuss how the atmosphere can be made more unstable, and stable.
d. Contrast and compare sleet and freezing rain.
e. List the four (4) major ways that clouds form.
f. Calculate the equivalence of rain and snow melt.
g. Describe the atmospheric conditions that produce sleet, and compare them to those that form hail.
h. Explain why rain shadows form on the leeward side of mountain ranges.
i. Contrast and compare the precipitation that falls from cumuliform clouds and stratoform clouds.
j. Discuss why thunderstorm clouds (cumulonimbus) have flat tops and flat bases.
k. Contrast and compare virga and fall streaks.
l. Explain the main principals of cloud seeding.
m. Calculate the air temperature at a given altitude when the air temperature at the surface and the relative humidity are known.

Competency 6: The Student will learn specific terms and achieve specific knowledge about the development of air pressure and wind.
The student will be able to:

a. Define terms relating to winds such as air pressure, millibar, barometer, isobar, anticyclone, contour lines, ridge, trough, pressure gradient, coriolis force, geostrophic wind, gradient wind, hydrostatic, onshore, offshore prevailing, wind vane, anemometer, monsoon.
b. List several ways to determine wind direction and wind speed without a meteorological instrument.
c. When given a weather map, determine the air pressure, wind speed, and direction at several selected weather stations.
d. Explain why air pressure always decreases with increasing altitude.
e. When given a weather map, locate high pressure areas, low pressure areas, ridges and troughs.
f. Describe how monsoon winds develop and give a specific sample of a country that is affected by these seasonal winds.
g. Make a sketch of a mercury barometer and briefly explain how the instrument measures air pressure.
h. Convert millibars into inches of mercury.
i. Using a sketch for each, draw the wind pattern around a low pressure area and high pressure area in the Northern Hemisphere. Do the same thing for low and highs south of the equator.
j. Explain why the air pressure in a city located at a high altitude will always be lower than that in Miami, Florida.
k. Determine the location of a low and high in specific vicinity if the wind is blowing against your back from the south.

Competency 7: The Student will learn specific terms and achieve specific knowledge about atmospheric circulation.
The student will be able to:

a. Define terms relating to atmospheric circulation such as microscale, highs, doldrums, trade winds, mesoscale, intertropical converge zone, macroscale, westerlies, wind shear, polar front, clear air turbulence (CAT), thermal circulation, sea breeze, land breeze, jet stream.
b. Draw a large circle representing the Earth. Place the major world pressure zones and prevailing winds and the correct location in each Hemisphere.
c. Explain the relationship that exists between the general circulation of the atmosphere and the circulation of the major ocean currents.
d. Describe how winds along the West Coast of North America produce upwelling.
e. Using a diagram for each, show why a sea breeze blows from the sea towards the land while a land breeze blows the opposite direction.
f. Explain why Chinook winds are dry and warm.
g. Using a sketch show how the El Nino ocean current develops and describe its possible importance.
h. When given a map of the region, show how the monsoon winds develop over the Indian subcontinent in both Winter and Summer.

i. Decribe how Katabatic winds develop.
j. Contrast and compare dust devils and tornadoes.