

**ESAS 1115**  
**SEVERE AND UNUSUAL WEATHER**

*Topical Outline and Reading Assignments*

*Text: Severe and Hazardous Weather, Rauber, Walsh and Charlevoix, Third Edition*

*For each chapter, define the “Key Terms” at the beginning of each chapter  
and answer each “Check Your Understanding” sections within the chapter.  
10 points per chapter*

**I. Thunderstorms Morphology and Radar Meteorology – Chapter 1, 2, 3, 18, 19**

- A. Structure and kinematics of a thunderstorm
- B. Thunderstorm classification
- C. Radar meteorology
  - a. History
  - b. Physics of radar in meteorological applications
  - c. Description of radar products and their uses
  - d. Shortcomings and limitations of weather radar
- D. Thunderstorm visualization and spotter's training
  - a. Understanding convective hazards
  - b. Storm classification
- E. Thunderstorm evolution and morphology
  - a. The Lemon Technique
  - b. Radar-based warning decisions

**II. Thermodynamics – The Workings of Storms – Chapter 6**

- F. Thermodynamics
  - a. Air parcels and environmental soundings
  - b. Water vapor's role in thunderstorm development
  - c. Static and convective instability
  - d. The thermodynamic diagram
- G. The planetary boundary layer
  - a. Mechanically-induced and thermally-induced turbulent eddies
  - b. Elevated mixed layers and dry line formation

**III. Synoptics – Putting It All Together – Chapter 7, 8, 9, 10**

- H. Synoptics and thunderstorm initiation
  - a. Fronts air masses and the jet stream
  - b. Development of wind
  - c. Long and short waves
- I. Vertical wind shear
  - a. Development of storm-scale rotation
  - b. Understanding hodographs
  - c. Unidirectional and curved shear
  - d. Tornadogenesis

#### **IV. El Niño, Hurricanes and Tropical Meteorology – Chapters 23, 24, 4**

- J. Tropical Meteorology
  - a. El Niño, the Southern Oscillation, and La Niña
  - b. The tropical atmosphere
  
- K. Tropical storms and hurricanes
  - a. Tropical storm development
  - b. Developing a general theory of hurricanes
  - c. Hurricane structure
  - d. Atmospheric circulations in terms of energetics
  
- L. Numerical models and weather prediction
  - a. Introduction to numerical weather prediction
  - b. The role of chaos in a dynamic environment
  - c. The unpredictability of weather and The Butterfly Effect
  - d. Strengths and shortcomings of numerical weather prediction