Study Guide for
Atmospheric Sciences 5270: Wind Power Meterology

You are responsible for reading the following sections in the *Wind Resource Assessment Handbook:*

1. INTRODUCTION

2. GUIDING PRINCIPLES OF A WIND RESOURCE ASSESSMENT CAMPAIGN

4. MONITORING STATION INSTRUMENTATION AND MEASUREMENTS

10. CHARACTERIZING THE OBSERVED WIND RESOURCE

11. ESTIMATING THE RESOURCE AT HUB HEIGHT

12. THE CLIMATE ADJUSTMENT PROCESS

13. WIND FLOW MODELING

14. UNCERTAINTY IN WIND RESOURCE ASSESSMENT

Subsections within the listed sections that will *not* be emphasized:

4.2. ADDITIONAL MEASUREMENTS

4.5. DATA LOGGERS

4.6. DATA STORAGE DEVICES

4.7. DATA TRANSFER EQUIPMENT

4.8. POWER SOURCES

4.9. TOWERS AND SENSOR SUPPORT HARDWARE

4.10. WIRING

11.2. TIME SERIES OF WIND SPEEDS

11.3. OTHER PARAMETERS

12.4. THE TARGET-REFERENCE RELATIONSHIP Data Binning; Predicting the Speed Distribution; Direction and Other Parameters

13.2. APPLICATION OF WIND FLOW MODELS

Example Questions

(The number after question is the relevant subsection in the *Wind Resource Assessment Handbook*.)

1. What is *wind resource assessment?* (1.0)
2. Most wind project development occurs at sites with mean annual wind speed at hub height greater than what speed? (1.2)
3. Why is knowledge of turbulence at a site is important for wind plant assessment? (1.2)
4. What is the purpose of short-term (1-12 hours) wind energy forecasting? (1.2)
5. Wind speed usually has a diurnal variation. At the vast majority of wind sites in North America, at the heights of modern, large wind turbines, at what time of day does the wind resource peak? (1.2)
6. In most of North America, with the exception of sites with strong warm-weather mesoscale circulations, the strongest winds usually occur during what season?
7. Why is knowledge of the frequency distribution of wind directions important for optimizing the layout of wind turbines? (1.2)
8. How does air density affect the amount of wind energy available at a given wind speed? (1.2)
9. What is a *wind turbine power curve?* (1.3)
10. What are the three stages of wind resource assessment? (2.0)
11. What are the fundamental measurements for a wind resource monitoring campaign? (4.1)
12. What are the three most common types of anemometers? (4.1)
13. What is the *data recovery fraction?* (10.1)
14. What is *wind shear?* (10.1)
15. What is *turbulence intensity?* (10.1)
16. What is *wind power density?* (10.1)
17. What is the wind speed frequency distribution especially useful for? (10.1)
18. What information can a *wind rose* display?
19. How (mathematically) does the power law equation relate the wind speeds at two different heights? (10.1)
20. What site conditions typically have the least wind shear? The most? (10.1: Table 10-3)
21. What is the typical hub height of modern large wind turbines? (11.1)
22. What is the most widely used method of extrapolating the mean wind speed from the height of observation to the turbine hub height? What is the main challenge of this method? (11.1)

23. How does the log profile relate the wind speeds at two different heights? (Lecture 6: Surface layer wind profiles; 11.1: Eq. 11-7)

24. What is the friction velocity? The roughness length? (Lecture 6: Surface layer wind profiles)

25. What is the purpose of the climate adjustment process? (12.0)

26. What is the key assumption underlying the climate adjustment process? (12.0)

27. What is the leading method for performing climate adjustments? (12.0)

28. What are the requirements for the climate adjustment process to be successful? (12.0, 12.2)

29. Is the wind climate stable? (12.1)

30. What other factors may affect the local wind climate? (12.1)

31. What are the pros and cons of using measurements from ASOS (Automated Surface Observing System) stations, rawinsonde stations, and reanalysis data sets for reference station data sets? (12.3)

32. What fitting method did you use in your HW to relate target and reference wind speeds? (12.4)

33. What is the main purpose of *wind flow modeling?* (13.0)

34. What are the four general categories of wind flow models? (13.1)

35. What are the four types of numerical wind flow models? (13.1)

36. Under what conditions does the WAsP model perform best? Under what conditions does the WAsP model perform poorly?(13.1)

37. How does a CFD model differ from a mesoscale NWP model? (13.1)

38. In what situations does a mesoscale NWP model usually out-perform other types of numerical wind flow models? (13.1)

39. The uncertainty present in all wind resource estimates is primarily related to what factors? (14.0)

40. What is the formula for the total uncertainty of two independent (uncorrelated) components? (14.3: Eq. 14-2)

41. What is the formula for the reduction of uncertainty by increasing the number of measurements? (14.3: Eq. 14-3)

42. What is the overall range of uncertainty for the array-average wind speed for typical wind projects? (14.6)