CVEN 664 – Water Resources Planning and Management
Study Questions #1

Introduction to Systems Theory

1. What is "scientific reductionism"? How is systems theory a reaction to reductionism? How did the rise of "modern" society historically fit into the development of systems theory? What is "ceteris paribus"? How is systems theory different from it?

2. What is a "system"? Be able to define the following terms in a systems context: components, boundary, interaction, closed, open, interface, environment, static, dynamic.

3. What is systems theory definition of the following: observation, notation, modeling? Must all notation be the same for a given system? Explain the "Principle of Indifference" and give your own example to illustrate this principle. Be able to identify violations of the principle if given an example system and its behavior.

4. What are the ideas of "state" and "state-space"? What is the maximum number of dimensions that state-space may assume? What is a "projection"? What is the "General Law of Complementarity"? How do projections relate to this law?

5. What is "state determinacy"? Is it desirable? Why or why not? State an example of a state determined system. What is the "diachronic principle"? Give an example.

6. How do the Principle of Indifference and the General Law of Complementarity intersect or not intersect? If it is known that two observers' collective notations violate the Principle of Indifference, does the Law of Complementarity still hold?

M&I Water Supply

1. What are the two "sides" of the general M&I water supply task? What are the 4 general categories of M&I uses? What is the overall objective of M&I supply?

2. What is a typical value of daily, per capita, indoor domestic water use? How and where was the value determined?

3. What is the typical range of variation for domestic outside water use (gpcd)? What are the factors determining this use?

4. How are M&I demands estimated for commercial use? What industries typically have water demands? Do these industries employ techniques to mitigate the impact of their water needs?

5. Be able to use a mass curve analysis to estimate needed reservoir volume for water supply development?

6. How are "storage pools" used in management of surface reservoirs? Be able to diagram a reservoir and its storage pools. How are "rule curves" used in reservoir management? What does it mean to change rule curves?

7. What techniques of demand management are available to water resources managers? How does each work? What is the "price elasticity of demand" and how is it useful?

Irrigation

1. What is the objective of an individual farmer? How does irrigation enter it the calculation of this objective?

2. How much of the water taken in by a plant is used for transpiration? Why do plants transpire?

3. How can evapotranspiration be directly measured? What is reference ET? How is reference ET different from potential ET? What is the accepted technique to estimate reference ET?

4. How is irrigation scheduled using the reference ET-crop coefficient technique? What is a crop coefficient? How and why does it change over time? What are the planning-level and management-level information sets produced by the ET_{ref}-K_c method?

5. What is deficit irrigation? How can crop yield losses due to drought stress be quantified? In words, state what the yield reduction formula means (e.g., "x is proportional to "y" and "z" is a constant of proportionality).

6. What is a crop-water production function? What is a net profit-water function? How are they useful? Be able to sketch them and show important features on the sketches. How would various environmental, agronomic, and economic factors change these functions?

7. What are the factors determining irrigation efficiency? What are common methods of conveyance and application and their respective efficiencies?

Flood Control and Floodplain Management

1. What is the difference between "flood control" and "floodplain management"?

2. What are common techniques to estimate flood magnitudes? What are their advantages and disadvantages?

3. Describe the process of hydraulic studies for floodplain determination. What are the products of this type of study?

4. Define the following: FIRM, SFHA, Floodway, 0.2% annual chance flood area, CLOMR, LOMR, NFIP. Why are these important?

5. Give examples of "structural" strategies for flood control.

6. Sketch a generalized "flood damage curve" and identify important features.

7. Discuss the history and performance of NFIP.

Hydropower

1. What are the advantages and disadvantages of hydropower versus electricity produced by other sources?

2. Based on the hydropower equation what is the functional relationship between power produced and the following: turbine flowrate, net head, efficiency? How is net head defined? Sketch a hydropower turbine and its important appurtenances.

3. What are common types of hydropower installations? Describe the hydrologic and operational aspects of each.

4. What does the hourly power system load look like for a typical day in summer? … in winter? How is power generation structured among various technologies to meet this demand? What is the exact role of hydropower in this schedule? What is the hydrologic impact of "peaking" operations?

5. Sketch the performance curves for a turbine. Explain the importance of various features of the curves (i.e., shape, curvature, multiple curves, etc.).