

Name: \_\_\_\_\_

CVEN 339 – Water Resources Engineering  
Summer Semester 2008  
Dr. Kelly Brumbelow Texas A&M University

Final Exam

**Open-book, Open-notes (8 pages, front & back, not including reference sheets; 18 questions)**

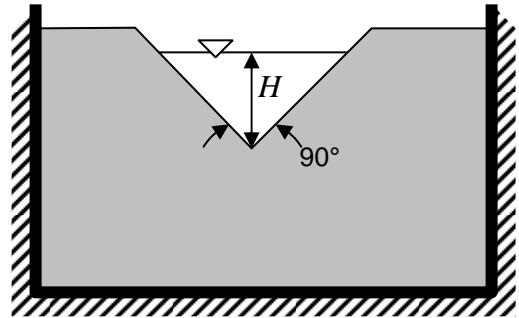
An excerpt from the NCEES *Fundamentals of Engineering Supplied-Reference Handbook* is attached to this exam. This excerpt is only for the use of students during this exam and must be returned at the conclusion of the exam.

Questions 1 to 12 are written in the format of the F.E. Exam Morning Section and should require on average 2 minutes per question to complete. Each question is worth 4 points. **Clearly write the letter corresponding to the best answer in the blank provided.**

1. Flow in an open channel passes over a v-notch weir as shown in the figure below. If the dimension  $H$  is equal to 11.2 ft, what will be the flowrate over the weir ( $\text{ft}^3/\text{sec}$ )?

- (A) 588
- (B) 1066
- (C) 1398
- (D) 95

Answer #1 \_\_\_\_\_

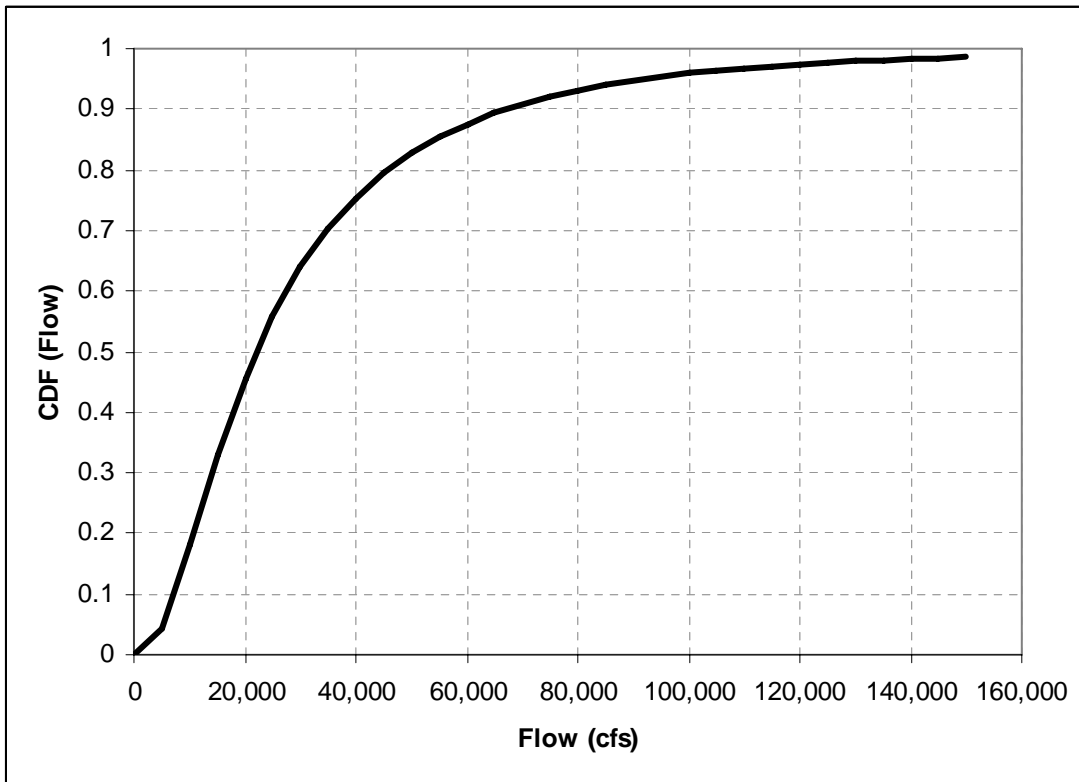


2. A large lake has surface area of  $13 \text{ mi}^2$ , which does not vary appreciably with water level changes. In a given year, precipitation on the lake is 36 inches, evaporation from the lake is 32 inches, inflow to the lake is 2000 acre-feet, and outflow from the lake is 3100 acre-feet. The change of volume in the lake over the year (acre-feet) is most nearly:

- (A) -1,048
- (B) +1,673
- (C) +3,873
- (D) +32,180

Answer #2 \_\_\_\_\_

3. The cumulative distribution function for streamflow ( $\text{ft}^3/\text{sec}$ ) measured at a streamgage is given below.



The streamflow value ( $\text{ft}^3/\text{sec}$ ) corresponding to the 50 year flood is most nearly:

- (A) 5,000
- (B) 10,000
- (C) 22,000
- (D) 130,000

Answer #3 \_\_\_\_\_

4. A watershed has a curve number of 62. What percentage of gross rainfall will become runoff from a storm of 0.9 inches falling in 30 minutes?

- (A) 0%
- (B) 6%
- (C) 62%
- (D) 78%

Answer #4: \_\_\_\_\_

5. A cast iron pipe in a water distribution system currently experiences a pressure drop along its length that is greater than desired. Which of the following changes would likely remediate this deficiency?

- I. Change the pipe material to plastic
- II. Increase the diameter of a pipe parallel to this one
- III. Increase the diameter of this pipe

- (A) I only
- (B) III only
- (C) I and III
- (D) I, II, and III

Answer #5 \_\_\_\_\_

6. In a confined aquifer the piezometric head at monitoring well “X” is measured to be 78.3 m, and the piezometric head at monitoring well “Y” is measured to be 77.2 m. The distance between the two wells is 500 m. If the transmissivity of the aquifer is  $32.4 \text{ m}^2/\text{day}$  and the thickness of the aquifer is 80 m, what is the bulk velocity of flow (m/day) in the aquifer:

- (A)  $4.46 \times 10^{-1}$
- (B)  $7.13 \times 10^{-2}$
- (C)  $8.91 \times 10^{-4}$
- (D)  $1.43 \times 10^{-4}$

Answer #6 \_\_\_\_\_

7. If a second pump is placed in series with an existing pump that inputs water to a long pipeline, which of the following would always be true?

- I. Flow through the pipeline will exactly double.
- II. The head loss in the pipeline will exactly double.

- (A) I only
- (B) II only
- (C) Both I and II
- (D) Neither I nor II

Answer #7 \_\_\_\_\_

8. In the year 2008, a 5 year flood occurs at a particular streamgage. What will be the probability of a 50 year flood occurring at the same streamgage in the year 2009?
- (A) 0.5
  - (B) 0.1
  - (C) 0.02
  - (D) 0.004

Answer #8 \_\_\_\_\_

9. A rectangular open channel has bottom width 10.0 ft, Manning's roughness coefficient 0.013, and a total constructed depth of 6.0 ft. If water flows in the channel at flow velocity 0.8 ft/sec and Froude number equal to 0.12, what is the volumetric flowrate in the channel?
- (A) 11.0 ft<sup>3</sup>/sec
  - (B) 1.65 ft<sup>3</sup>/sec
  - (C) 48.0 ft<sup>3</sup>/sec
  - (D) 1530 ft<sup>3</sup>/sec

Answer #9 \_\_\_\_\_

10. The 7Q10 flow at a streamgage has been determined to be 725 ft<sup>3</sup>/sec. Which of the following statements is not true?
- I. The 5Q10 flow is less than 725 ft<sup>3</sup>/sec.
  - II. The 7Q25 flow is greater than 725 ft<sup>3</sup>/sec.
  - III. The flow at this streamgage will never be less than 725 ft<sup>3</sup>/sec.
- (A) I only
  - (B) III only
  - (C) Both I and II
  - (D) Both II and III

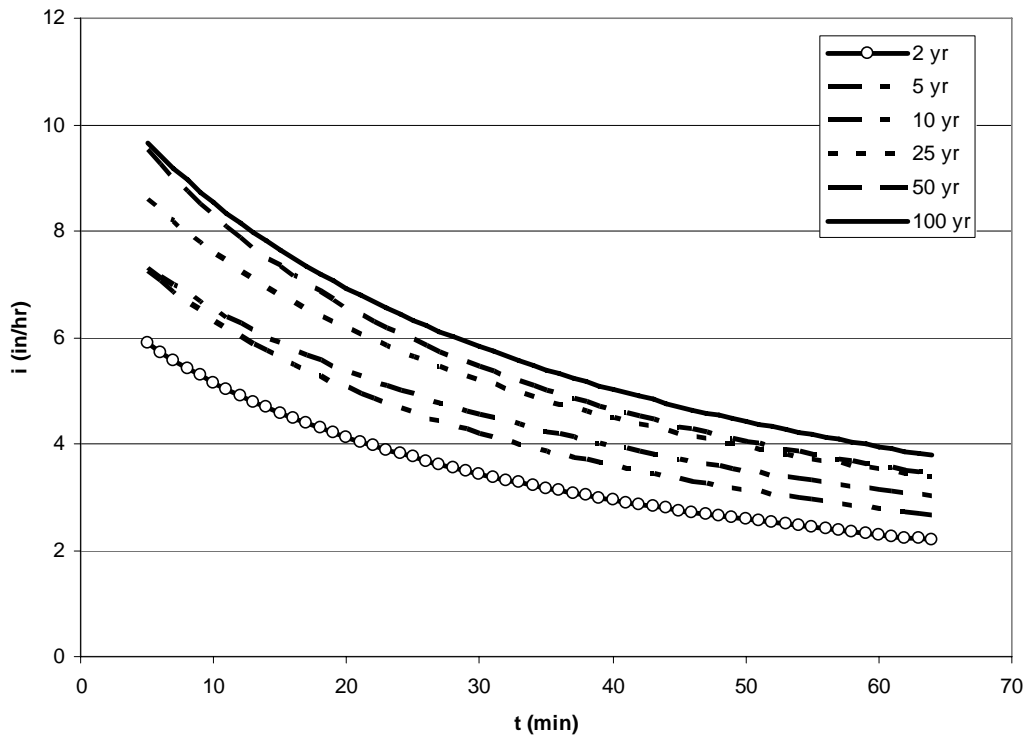
Answer #10 \_\_\_\_\_

11. In order to determine the steady-state drawdown curve for a well in an unconfined aquifer, what parameters are needed?

- (A) Well flow, saturated hydraulic conductivity, radius of influence, and undisturbed piezometric head
- (B) Well flow, transmissivity, radius of influence, and undisturbed piezometric head
- (C) Well flow, saturated hydraulic conductivity, radius of influence, storage coefficient, and undisturbed piezometric head
- (D) Well flow, saturated hydraulic conductivity, radius of influence, time, and undisturbed piezometric head

Answer #11 \_\_\_\_\_

12. According to the Rational Method and the IDF curves below, the magnitude of the 25 year design flood for a watershed having area  $0.1 \text{ mi}^2$ , runoff coefficient 0.35, and time of concentration 45 minutes is:



- (A)  $94 \text{ ft}^3/\text{sec}$
- (B)  $83 \text{ ft}^3/\text{sec}$
- (C)  $1.58 \text{ ft}^3/\text{sec}$
- (D)  $0.15 \text{ ft}^3/\text{sec}$

Answer #12: \_\_\_\_\_

Questions 13 to 18 are written in the format of the F.E. Exam Afternoon Section and should require on average 4 minutes per question to complete. Each question is worth 8.7 points. **Clearly write the letter corresponding to the best answer in the blank provided.**

13. Three monitoring wells have been drilled into an unconfined aquifer. The coordinates and piezometric head at each well are:

- Well 1: (500 ft, 500 m), head = 76.1 ft
- Well 2: (2600 ft, 2000 ft), head = 82.8 ft
- Well 3: (700 ft, -200 ft), head = 74.2 ft

The aquifer's saturated hydraulic conductivity is 0.31 m/day. The average velocity of flow in this aquifer is:

- (A)  $9.88 \times 10^{-4}$  ft/day
- (B)  $3.15 \times 10^{-3}$  ft/day
- (C)  $5.92 \times 10^{-3}$  ft/day
- (D)  $1.80 \times 10^{-3}$  ft/day

Answer #13 \_\_\_\_\_

14. The 1 hr unit hydrograph for a watershed is given below. If a storm of duration 2 hrs and 2.9 in runoff depth falls on this watershed, the peak of the runoff hydrograph resulting from the storm is most nearly:

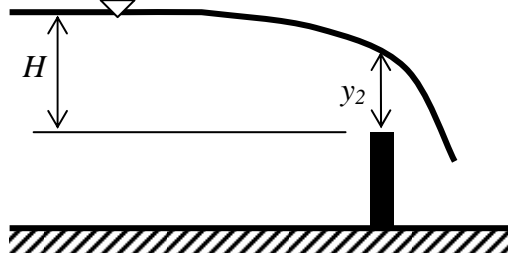
Time (hrs)	1 hr Unit Hydrograph (cfs/in)
0	0
0.5	72
1	135
1.5	142
2	95
2.5	24
3	0

- (A) 206 cfs
- (B) 334 cfs
- (C) 412 cfs
- (D) 896 cfs

Answer #14 \_\_\_\_\_

15. Water flowing in a 8.5 ft wide rectangular open channel must flow over a sharp-crested weir as shown in the figure below. At the weir crest, the depth of water above the crest  $y_2$  is 0.53 ft. What is the correct value of the dimension  $H$  measured far upstream of the weir?

- (A) 1.56 ft
- (B) 1.12 ft
- (C) 0.76 ft
- (D) 0.53 ft



Answer #15 \_\_\_\_\_

16. A pumping station includes 2 pumps in series. Each individual pump has the characteristic curve defined below:

$$\text{Head (ft)} = 100 - 0.007 Q^2 - 0.52 Q \quad (Q \text{ in gpm})$$

The pipe network has a static head of 35 ft. The friction loss is defined by the following equation:

$$\text{Friction loss (ft)} = 0.012 Q^2 \quad (Q \text{ in gpm})$$

The flow rate (gpm) delivered by the pump station in operation is most nearly:

- (A) 62
- (B) 70
- (C) 46
- (D) 90

Answer #16 \_\_\_\_\_

17. The 1 hr unit hydrograph given below was calculated from the rainfall-streamflow data for a 25 year flood. Which of the following statements can be shown to be true with the given data?

Time (hrs)	1 hr Unit Hydrograph (cfs/in)
0	0
1	1300
2	850
3	120
4	0

- I. If the unit hydrograph had been calculated from data for the 100 year flood, its peak would be greater than 1300 cfs/in.
- II. The watershed's peak runoff flow for the 5 year flood would be less than 1300.
- III. The unit hydrograph has a 4% probability of being applicable in any given year.

- (A) III only
- (B) I and III
- (C) I, II, and III
- (D) None of the above

Answer #17 \_\_\_\_\_

18. A region experiences a changing climate where annual average rainfall is unchanged but storms tend to be shorter and more intense. Which of the following statements would be true?

- (A) The IDF curves for the region would shift upward for all durations.
- (B) The IDF curves for the region would shift downward for short durations and upward for long durations.
- (C) The IDF curves for the region would shift upward for short durations and downward for long durations.
- (D) Changes in the IDF curves for the region would differ depending on return period.

Answer #18 \_\_\_\_\_