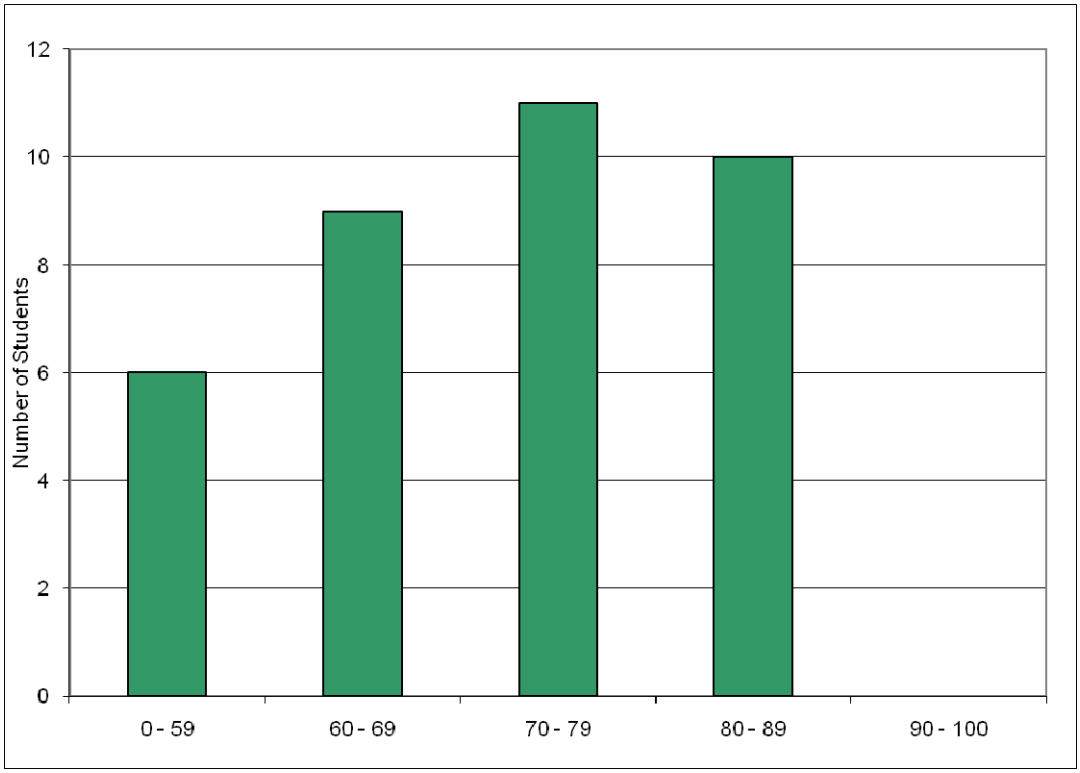
CVEN 339 – Summer 2009 – Final Exam

120 minutes allowed

36 Students

No curve applied to grades

Median	70.6
Mean	68.7
Std. Dev.	13.7
High	88
Low	24.5



Name: _____

CVEN 339 – Water Resources Engineering
Summer Semester 2009
Dr. Kelly Brumbelow Texas A&M University

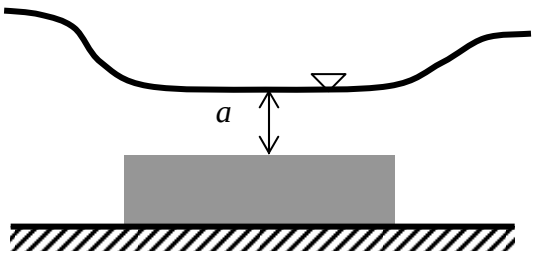
Final Exam

Open-book, Open-notes (8 pages, front & back, not including answer sheet; 18 questions)

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 on the answer sheet.**

1. Flow in an open channel passes over a broad-crested weir as shown in the figure below. If the dimension *a* is equal to 2.6 ft and the width of the channel is 8.9 ft, what is the flowrate in the channel (ft^3/sec)?

   (A) 71
   (B) 81
   (C) 117
   (D) 212



2. Which of the following watershed and storm properties are included in the NRCS curve number method for runoff calculation?

   I. Soil type
   II. Land cover
   III. Runoff coefficient
   IV. Storm precipitation total
   V. Storm duration

   (A) I and II
   (B) I, II, and IV
   (C) III and IV
   (D) I, II, IV, and V

3. The pump characteristic curve for a single pump is defined below:

   Head (ft) = $185 - 0.3\ Q^2 - 3.5\ Q$ (Q in cfs)

   The pump is used to pump water from one reservoir to another reservoir that is 100 ft higher. The friction loss for the pipeline between the reservoirs is defined by the following equation:

   Friction loss (ft) = $0.60\ Q^2$ (cfs) for 2 cfs < Q < 12 cfs

   The flowrate (cfs) through the pipeline is most nearly:

   (A) 11.3
   (B) 8.8
   (C) 8.0
   (D) 4.5

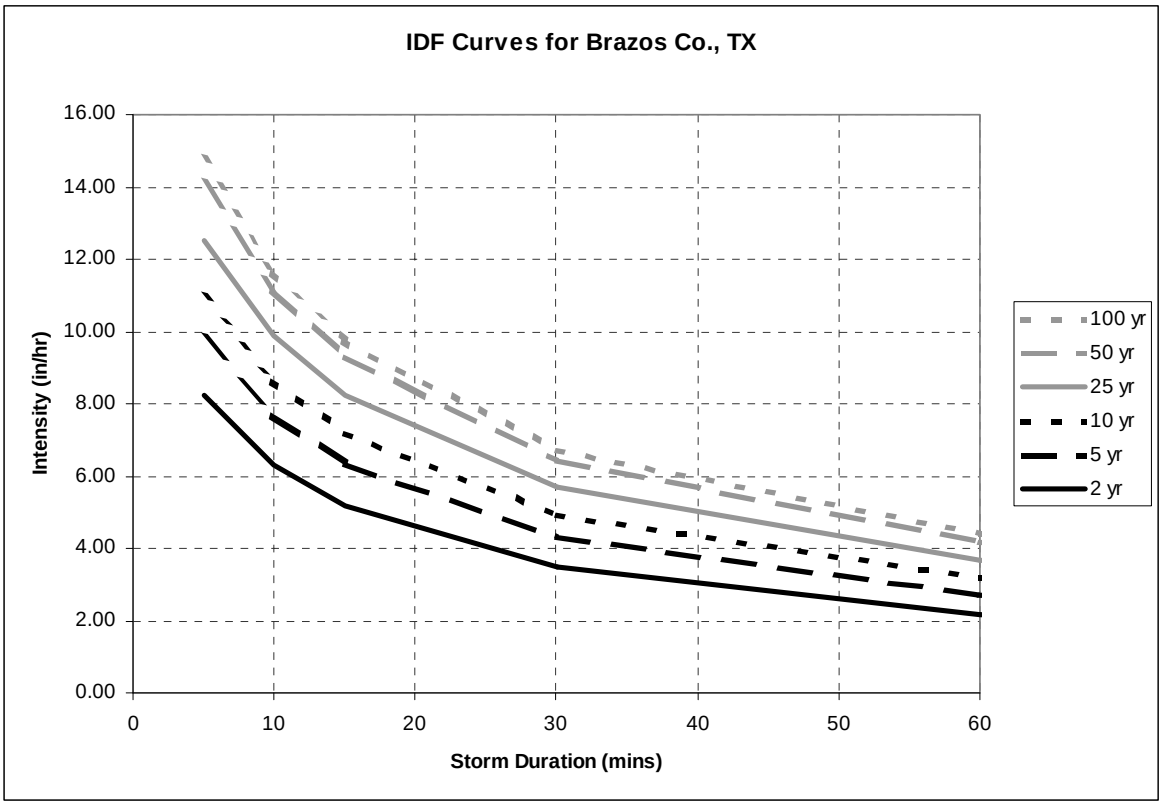
4. A 16 inch diameter well is drilled in an unconfined aquifer (saturated hydraulic conductivity = 0.54 ft/day). If the undisturbed water table in the aquifer was 210 ft above the aquifer's lower confining layer, what well flowrate (cfs) will produce drawdown of 55 ft and a radius of influence of 850 ft?

   (A) 0.055
   (B) 0.061
   (C) 4766
   (D) 9752

5. A trapezoidal open channel has bottom width 8.5 ft, Manning's roughness coefficient 0.014, 1.8H:1V sideslopes, longitudinal bedslope 0.0008, and a total constructed depth of 6.0 ft. If water flows in the channel at flow velocity 4.0 ft/sec and depth 2.1 ft, what is the value of Froude number for the flow?

   (A) 1.61
   (B) 0.55
   (C) 0.49
   (D) 0.29

Use the figure below to solve problems 6 and 7.



6. Peak runoff of 330 ft^3/sec is computed for a specific watershed using the Rational Method, the IDF curves given above, and a 25 year storm. If the watershed has time of concentration 50 minutes, what would be the expected peak runoff for a 50 year storm?

   (A) 660 ft^3/sec
   (B) 384 ft^3/sec
   (C) 295 ft^3/sec
   (D) 229 ft^3/sec

7. What is the expected precipitation depth (inches) for the 30 minute duration storm having annual probability of occurrence 0.20?

   (A) 2.15
   (B) 2.75
   (C) 4.30
   (D) 5.50

8. A pond has surface area of 84 acres, which does not vary appreciably with water level changes. At the beginning of a 30 day period, the volume of water in the pond is 923 acre·feet. During this 14 day period, 3.22 inches of rain falls on the pond, 0.95 inches of evaporation occurs from the pond. The pond's average inflow is 5.9 ft^3/sec, and average outflow is 8.2 ft^3/sec. The volume of water in the pond at the end of the 14 day period (acre·feet) is most nearly:

   (A) 875
   (B) 937
   (C) 971
   (D) 1050

9. A detention reservoir's only outfall structure is an ogee spillway weir. In order to route an inflow hydrograph through the reservoir, what information would be required?

   (A) Weir discharge coefficient, reservoir depth versus area relationship, energy loss in hydraulic jump at base of spillway, unit hydrograph for area upstream of reservoir
   (B) Muskingum K and X, weir discharge coefficient
   (C) Weir discharge coefficient, reservoir depth versus area relationship
   (D) Reservoir depth versus area relationship, Manning's n

10. The pump characteristic curve for a single pump is defined below:

    Head (ft) = $135 - 0.0001\ Q^2 - 0.03\ Q$ (Q in gpm)

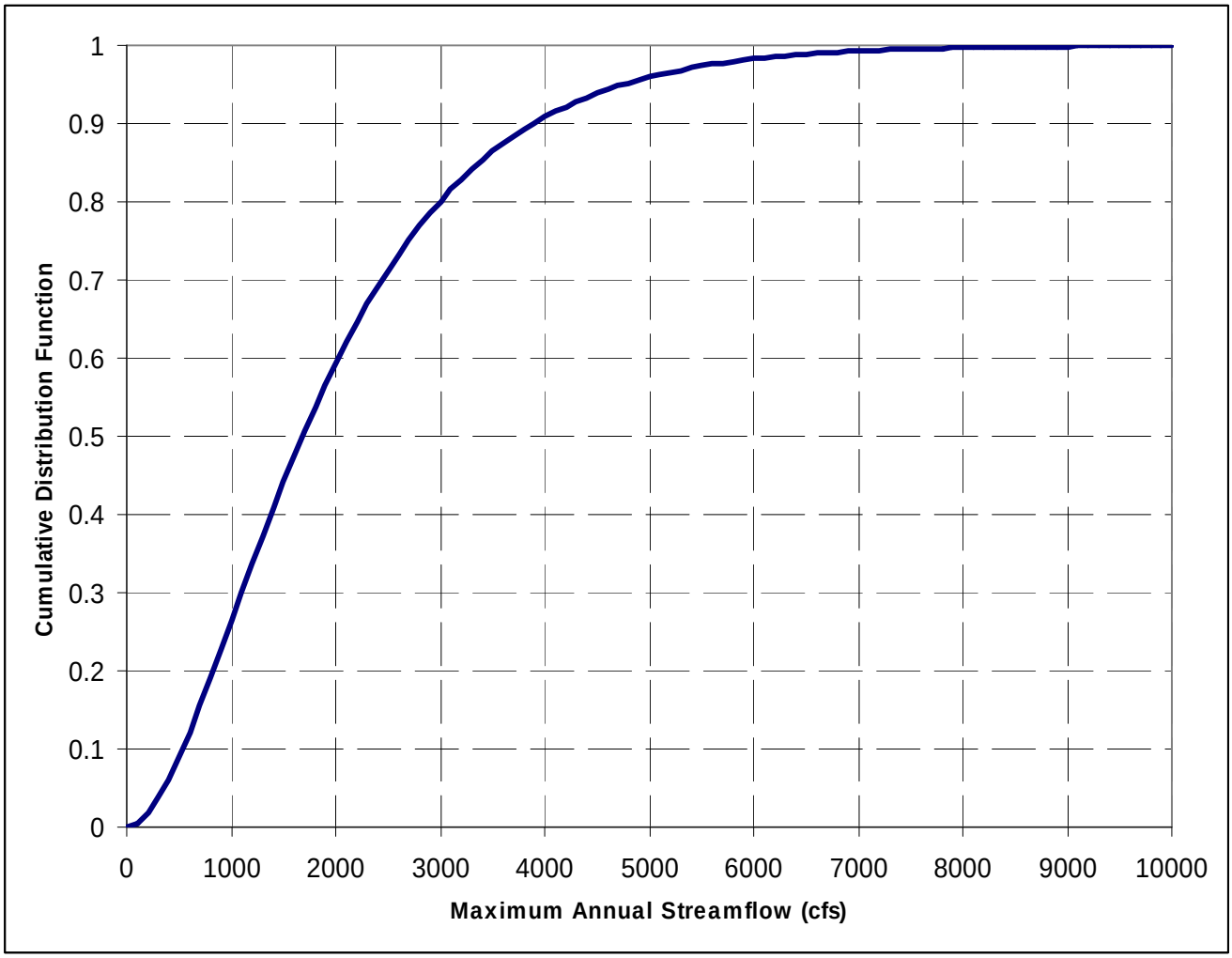
    The pipeline the pump feeds has a static head of 82 ft. The friction loss for the pipeline is defined by the following equation:

    Friction loss (ft) = $0.0024\ Q^2$ (gpm) for 25 gpm < Q < 500 gpm

    If the length of the pipeline is doubled and a second identical pump is placed in series with the existing pump, what will be the flowrate (gpm) in the pipeline?

    (A) 140
    (B) 280
    (C) 258
    (D) 188

Use the figure below to solve problem 11.



11. The magnitude of the 2 year flood for this stream would be most nearly:

(A) 7000 cfs
(B) 1600 cfs
(C) 300 cfs
(D) 3000 cfs

12. Which of these statements regarding unit hydrographs is true?

I. The peak value for a 2 hr unit hydrograph derived from the 25 year flood will be higher than the peak value for a 1 hr unit hydrograph derived from the 5 year flood.
II. The unit hydrograph flow ordinates (cfs/in) must be each multiplied by the storm precipitation (in) to determine the runoff flow (cfs) values.
III. In the process of deriving a unit hydrograph from measured rainfall and streamflow data, it is possible to estimate a watershed's runoff coefficient.
IV. A unit hydrograph derived from measured rainfall and streamflow data is preferable to one determined using the NRCS curvilinear hydrograph method.

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

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: (9500 m, 6200 m), head = 132.3 m
Well 2: (9000 m, 5400 m), head = 137.6 m
Well 3: (8500 m, 6400 m), head = 135.9 m

The aquifer's saturated hydraulic conductivity is 0.07 m/day. The average velocity and direction of flow in this aquifer is:

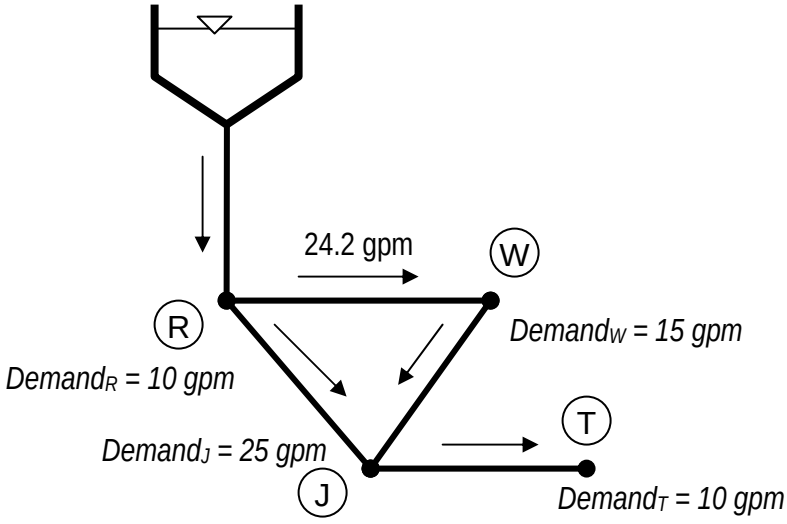
(A) 0.0049 m/day, 41.6° south of due west
(B) 0.0064 m/day, 41.6° south of due west
(C) 0.0049 m/day, 41.6° north of due east
(D) 0.0064 m/day, 48.4° north of due east

14. A pipe network is shown in the drawing below. Demands are indicated for all nodes, flow directions are indicated for all pipes, and flow magnitude is indicated for one pipe. All nodes are at elevation 0 ft except the fixed-grade node, which has a free water surface at elevation 135 ft. The friction loss for each pipe is defined by the following equation:

Friction loss (ft) = $0.0059\ Q^2$ (gpm) for 2 gpm < Q < 500 gpm

What is the pressure at node T?

(A) 6820 psi
(B) -53.2 psi
(C) 58.5 psi
(D) 47.3 psi



15. In which of the following hydrologic analyses would latent heat be a necessary parameter?

I. Calculation of runoff from a thunderstorm given measured rainfall
II. Assessment of potential water supply from snowpack in a mountainous watershed
III. Prediction of soil moisture content over the course of a summer
IV. Estimation of exfiltration rate from an aquifer

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

16. A thunderstorm rains 5.62 inches on a watershed. The depth of runoff from this storm is 2.14 inches. The value of NRCS curve number for the watershed is most nearly:

(A) 80
(B) 66
(C) 7
(D) 38

17. A river reach has Muskingum parameters K = 2 hrs and X = 0.20. If outflow from the reach is 37 cfs at time t = 0, what will be the outflow at time t = 2 hrs resulting from the inflow hydrograph below?

Time (hrs)	Inflow Hydrograph (cfs)
0	37
1	75
2	150
3	120
4	65
5	43
6	37

(A) 60 cfs
(B) 39 cfs
(C) 86 cfs
(D) 46 cfs

18. A rectangular open channel (n = 0.014, S_o = 0.00028) experiences a transition where the channel widens and the channel bottom is raised as a gradual step (Δz = 0.25 m). If the width of the channel is 8.0 m before the transition and 12.0 m after the transition, what will be the head loss (m) in the transition when the flowrate is 17.2 m^3/sec?

(A) 0.010
(B) 0.077
(C) 0.026
(D) 0.20