University of Palestine

Course No:CVL 4332
Course Title: Hydrology
Date: 31 / 05 /2018
No. of Questions:
Time: 120 Minutes
Using Calculator (Yes)

Final Exam
2017/2018
Total Grade: 50

Instructor Name: Dr. Osama Dawoud
Student No.: _____
Student Name: _____
College Name: Engineering
Dep. / Specialist: Civil Engineering
Using Dictionary (No)

First Question	1	2	3	4	5	6	7	8	9	10
Answer										

Second Question	1	2	3	4	5	6	7	8	9	10
Answer										

Third Question	1	2	3	4	5	6	7	8	9	10
Answer										

IMPORTANT:

- **Move your answers to the dedicated tables in this sheet**
- **Do not exceed the dedicated space for the answer. <u>No extra sheets are allowed.</u>**

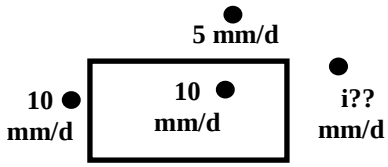
Please Answer All Questions

First Question (10/50)

1. For the exponential CDF $F(x) = 1-e^{-\lambda t}$, which of the following is true:
   A. λ is the mean of the data
   B. $\lambda = 1/t$
   C. t cannot be negative
   D. CDF is equal to PDF at any point.
   E. All of the above
   F. None of the above.

2. Water could move:
   A. Upward in unsaturated zone by capillary rise
   B. Downward in vadose by gravity
   C. Horizontally by pressure gradient in confined aquifer
   D. Horizontally by pressure gradient in unconfined aquifer
   E. All of the above
   F. None of the above.

3. What would be the areal precipitation intensity of the rectangular watershed based on the rain gauges readings and according to arithmetic mean method:
   A. Data is missing
   B. 10 mm/d
   C. 7.5 mm/d
   D. 8.33 mm/d



4. If the function of the infiltration capacity (cm/hr) at any time (t) can be described as:

$$\mathbf{f = 0.2 + 1.3\, e^{-0.35t}}$$

Then the total depth that infiltrated in the soil from the beginning of the storm during the first 6 hrs would be:
   A. 0.2 cm
   B. 1.3 cm
   C. 0.3592 cm
   D. 4.46 cm
   E. No infiltration occurs

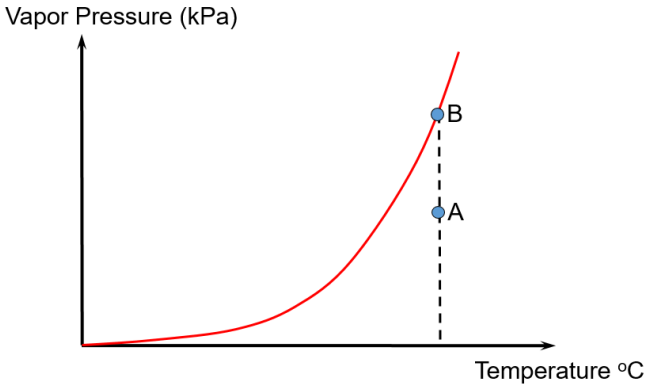
5. When the piezometric head in a well is above ground surface, then it is called:
   A. Confined aquifer
   B. Spring
   C. Perched Well
   D. Artesian Well
   E. Piezometric
   F. Groundwater

6. A natural watershed that exhibits a certain unit hydrograph U_1. If the watershed was developed (percentage of impervious surfaces increased) and U_1 changed into a new unit hydrograph U_2. Which of the following statements are true?
   A. Area under U_1 equals the area of the watershed
   B. Area under U_2 equals the area of the watershed
   C. The peak of U_2 is more likely greater than U_1
   D. All of the above
   E. None of the above

7. If the rainfall depth that precipitated during 20 min is 0.5 cm. The rainfall intensity equals:
   A. 1.5 cm/hr
   B. 1.0 cm/hr
   C. 0.5 cm/hr
   D. 0.22 cm/hr
   E. 0.025 cm/hr

8. The use of Double Ring for estimating the infiltration in the field aims at
   A. Facilitating the water infiltration
   B. Avoiding effect of ambient temperature
   C. Avoiding effect of lateral flow
   D. Comparing inner and outer infiltration

9. The curve shown in the figure represents. If the vapor pressure was measured to have value A. Then the saturation vapor pressure at dew point temperature is:
   A. (B-A)/A
   B. B/A
   C. A/B
   D. B
   E. A
   F. 0.622e/(P-0.378e)



10. If a soil has a hydraulic conductivity (K) for water as a permeant. If water is mixed with a material that increased water viscosity and caused no change to density, then the soil hydraulic conductivity becomes:
    A. No change would occur to soil permeability
    B. Permeability will increase
    C. Permeability will decrease
    D. None of the above

Second Question (5/50)

Check whether the following statements are true (✓) or False (✗):

1. Φ-index that is used to describe infiltration is always a positive value.

2. Dupuit equation can be used to describe the radial flow to a well that is located close to a river.

3. The main assumption for the Horton's equation for infiltration is that the rainfall intensity is always greater than the infiltration capacity.

4. Transmissivity represents the volume of water that aunit volume of soil can yield for a drop in hydraulic head.

5. For calculating Darcy's velocity, one shall consider the whole area of the soil specimen.

6. Area under the total runoff hydrograph is necessarily equal to the watershed surface area.

7. Snyder's synthetic hydrograph is not symmetric around the vertical line that passes through the peak flow.

8. Rational method application shall be restricted to small catchments.

9. For unconfined aquifers, the specific yield is considered equivalent to the storage coefficient

10. Base flow added to the hydrograph represents the rainfall that does not change into runoff

Third Question (5/50)

Match the terms with their definitions

A. Vadose zone	**B.** Excess rainfall	**C.** Depression Storage	**D.** Ponding	**E.** Drawdown
F. Percolation	**G.** Wilting point	**H.** Aquitard	**I.** Hydraulic conductivity	**J.** Infiltration

1.	The unsaturated zone that is located above the surface of the saturated aquifer.
2.	The difference between existing water table elevationwith and without pumping.
3.	Caused by the presence of small ponds and puddles in the ground surface.
4.	Equals the direct runoff in volume.
5.	Movement of the water that exists above soil surface down into the soil.
6.	A parameter that controls the seepage flow through porous media, and it is governed by both of the soil and the fluid characteristics.
7.	Water movement from unsaturated soil down to the saturated surface.
8.	A saturated stratum that is semi-permeable.
9.	The process that describes accumulation of infiltrating water above the surface
10.	The minimal point of soil moisture the plant requires not to wilt

Fourth Question **(10/50)**

A. A well is constructed to pump water from a confined aquifer. Two observation wells, A and B, are constructed at distances of 100 m and 1000 m, respectively. Water is pumped from the pumping well at a rate of 0.01 m^3/s. At steady state, drawdown s' is observed as 2 m atB and 8 m atA. Determine the hydraulic conductivity K and transmissivity T if the aquifer is 20 m thick.

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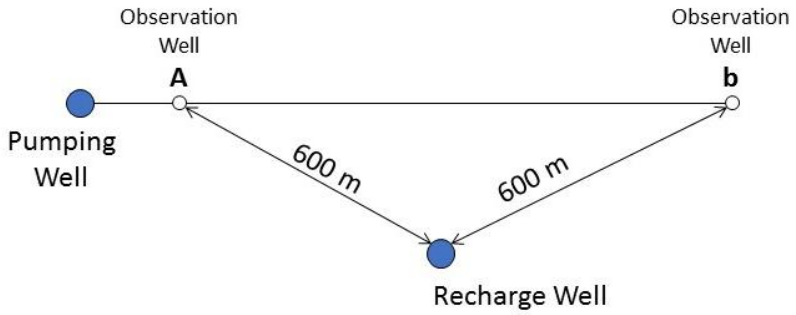
B. For the previous condition, if a recharge well was located at a distance of 600 m from both of the two observation wells **A** and **B** as shown in the figure. Find the new drawdown in the observation wells if the recharge was conducted at a rate of 0.01 m^3 /s.



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Fifth Question (10/50)

a. Find the 10-yr peak flow using normal distribution model.

Year	Peak Flow (cfs)		
1925	18,800		
1926	16,800		
1927	19,500		
1928	30,700		
1929	11,200		
1930	11,500		
1931	34,100		
1932	21,800		
1933	19,800		
1934	28,700		
1935	15,000		
1936	19,600		
Sum	247,500		
Average	20,625		
Standard Deviation	7,226		

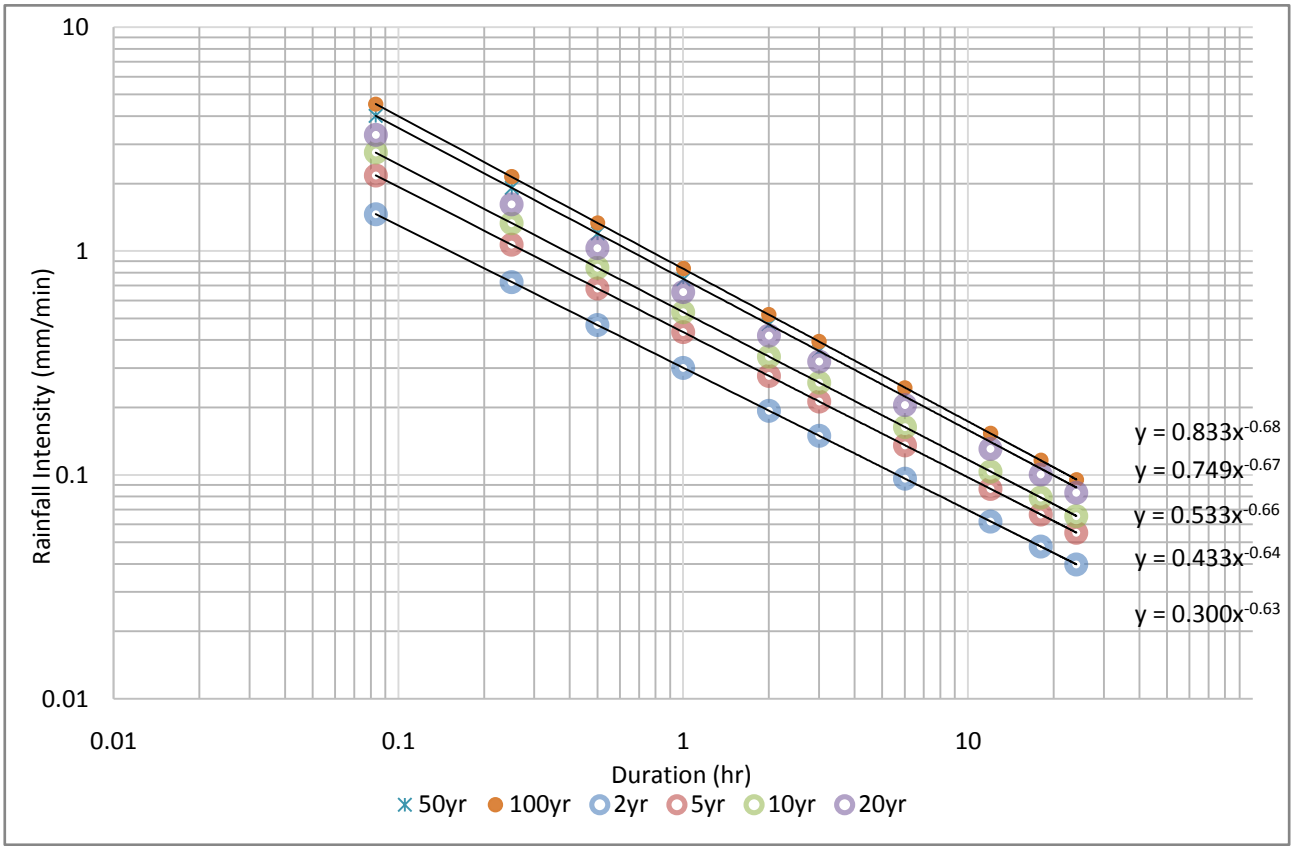
b. What is the probability that the flow exceeds 20,000 cfs at any year? Use <u>log-normal</u> distribution model.

c. Find the probability distribution model that best fits the data?

Sixth Question (10 points)

Use the rational method and IDF curves to calculate the maximum flow of 2-yr and 5-yr storms that will occur the drainage point of a 5000 m^2(0.5 ha) school. The longest flow path was estimated as 130 m and the average slope is 0.003 m/m. The school is totally paved.

Development	Coefficient
Pavement, Road, Parking	0.9
Commercial/Public Lots	0.7
Residential Communities	0.6
Parks/Unimproved Areas	0.3
Irrigation Areas	0.2
Natural Zones	0.05



Formula sheet

$$Q_n = C_0 I_n + C_1 I_{n-1} + C_2 Q_{n-1}$$

$$C_0 = \frac{-Kx + \Delta t/2}{D} \qquad C_2 = \frac{K - Kx - \Delta t/2}{D}$$

$$C_1 = \frac{Kx + \Delta t/2}{D} \qquad D = K(1-x) + \Delta t/2$$

$$P(x) = \frac{n!}{x!(n-x)!} p^x (1-p)^{n-x}$$

$x = 0, 1, 2, 3, ..., n$

$$F(t) = 1 - e^{-\lambda t}$$

$$e_s = 2.7489 \times 10^8 \exp\left(-\frac{4278.6}{T + 242.79}\right)$$

$$(I_n + I_{n+1}) + \left(\frac{2S_n}{\Delta t} - Q_n\right) = \left(\frac{2S_{n+1}}{\Delta t} + Q_{n+1}\right)$$

Confined

$$T = Kb = \frac{Q}{2\pi(h_2 - h_1)} \ln \frac{r_2}{r_1}$$

Unconfined

$$K = \frac{Q}{\pi (h_2^2 - h_1^2)} \ln \frac{r_2}{r_1}$$

$$P = \sum \frac{A_i P_i}{A_i} \qquad P = \sum \frac{P_i W_i}{W_i}$$

$$W = 1/D^2$$

Qp = CiA

Kirpich equation $t_c = 0.0195 L^{0.77} / S^{0.385}$

Standard deviation: $S = \sqrt{\frac{-n\bar{x} + \Sigma x^2}{n-1}}$

$$\text{Skewness} = \frac{n}{(n-1)(n-2)} \sum \left(\frac{x_i - \bar{x}}{s}\right)^3$$

Reliability = $(1-p)^n$

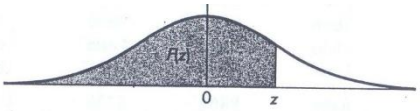


TABLE D.3.1

Cumulative Normal Distribution*

$$F(z) = \int_{-\infty}^{z} \frac{1}{\sqrt{2\pi}} e^{-z^2/2}\, dz$$

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441
1.6	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633
1.8	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706
1.9	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767
2.0	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.1	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890
2.3	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916
2.4	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936
2.5	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952
2.6	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964
2.7	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9972	.9973	.9974
2.8	.9974	.9975	.9976	.9977	.9977	.9978	.9979	.9979	.9980	.9981
2.9	.9981	.9982	.9982	.9983	.9984	.9984	.9985	.9985	.9986	.9986
3.0	.9987	.9987	.9987	.9988	.9988	.9989	.9989	.9989	.9990	.9990
3.1	.9990	.9991	.9991	.9991	.9992	.9992	.9992	.9992	.9993	.9993
3.2	.9993	.9993	.9994	.9994	.9994	.9994	.9994	.9995	.9995	.9995
3.3	.9995	.9995	.9995	.9996	.9996	.9996	.9996	.9996	.9996	.9997
3.4	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9998