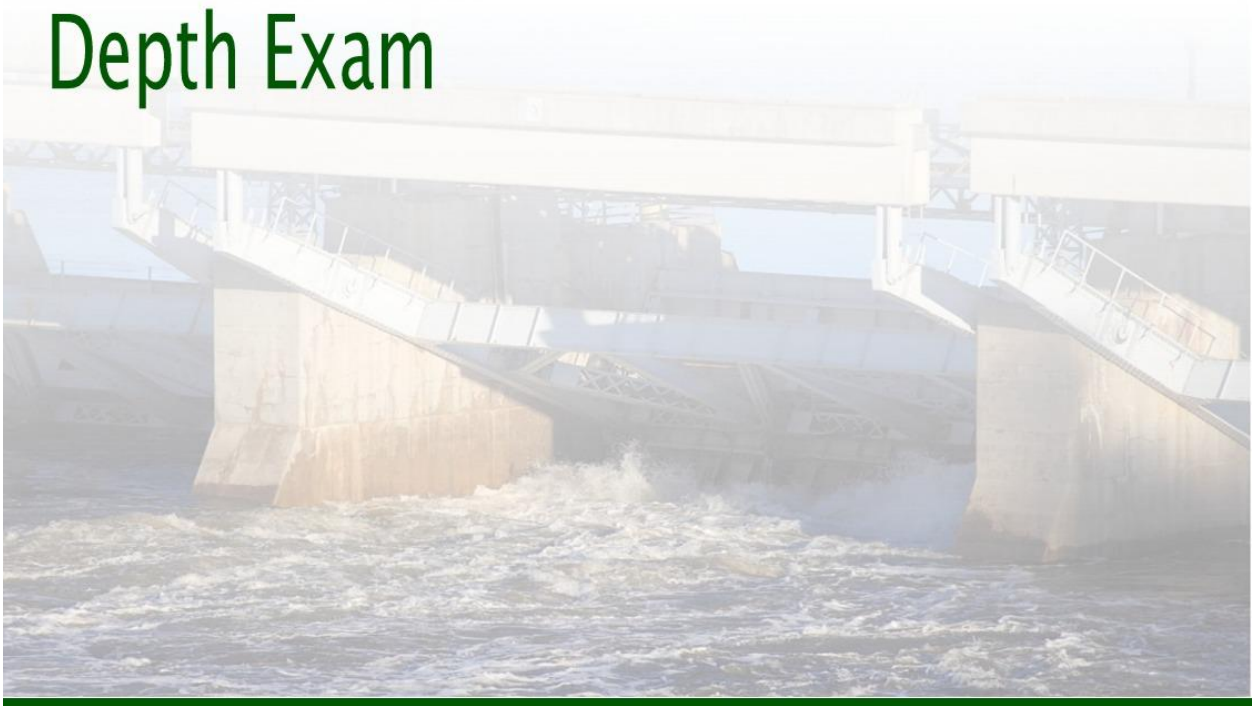
New Edition: Updated to 2015 Exam Design Standards

PE Civil Exam

Water Resources and Environmental Depth Exam



E-book 80 solved problems for Evening Session

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PE Civil Exam 80- **Water Resources and Environmental** Questions & Answers (pdf Format)

Depth Exam (Evening Session)

PE Civil Depth Exam (Evening Session):

This practice exam contains 80-questions and answers from all Water Resources and Environmental.

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Total	**80 Problems**	

I. Analysis and Design -8

A. Mass balance

B. Hydraulic loading

C. Solids loading (e.g., sediment loading, sludge)

D. Hydraulic flow measurement

(Ref:NCEES)

1. **PROBLEM** (Mass balance)

A natural lake does not have any chemical reactions; it has initially contained 1500 tons of water. Three months period 800 tons of water has flowed into the lake. The 100 tons of water has been from rain into the lake. The 300 tons of water flow out of the lake, 100 tons of water pumped for irrigation purpose and 50 tons of water have lost from the lake evaporation. What is the amount of water in the lake at the end of the period?

a. 1500 tons
b. 1950 tons
c. 1150 tons
d. 2300 tons

1. **SOLUTION:**

Where,

Initial mass of water=1500 tons

Water flow into the lake = 800 tons

Out of water from Lake = 300 (Flow) + 50 (Evaporation) = 350 tons

Generation of water in Lake =100 (Rainwater) tons

Consumption of water in Lake = 100 (Pumped) tons

The mass balance equation:

Accumulation of water, W= in of water – Out of water + Generation of water – Consumption of water.

The general balance equation, W = 800 – 350 + 100 – 100 = 450 tons

Final mass of water in Lake= Initial mass of water +W

=1500+450= 1950 tons

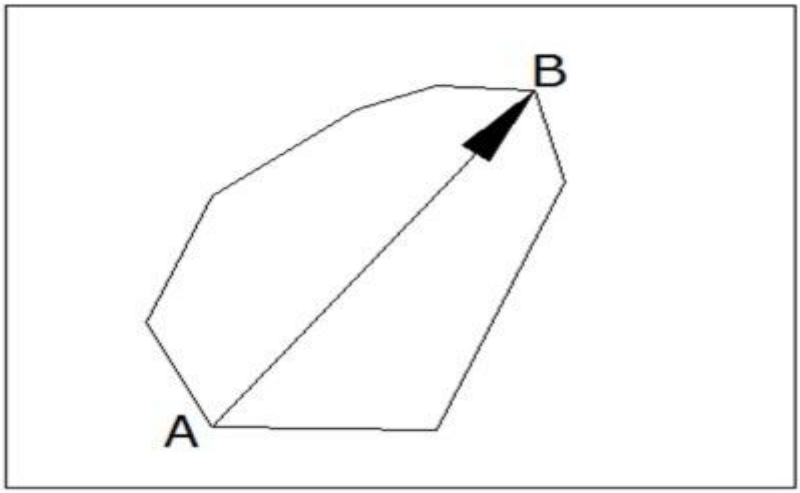
The Correct Answer is: (b)

IV. Hydrology-14

A. Storm characteristics (e.g., storm frequency, rainfall measurement, and distribution)
B. Runoff analysis (e.g., Rational and SCS/NRCS methods)
C. Hydrograph development and applications, including synthetic hydrographs
D. Rainfall intensity, duration, and frequency
E. Time of concentration
F. Rainfall and stream gauging stations
G. Depletions (e.g., evaporation, detention, percolation, and diversions)
H. Stormwater management (e.g., detention ponds, retention ponds, infiltration systems, and swales)
(Ref:NCEES)

28. PROBLEM (Rainfall measurement)

Calculate the time concentration of sheet flow of the small urban watershed, has 225 mm rainfalls for 2-year, 24-hour. The length of sheet flow is 100 meter and average 2% slope of the land surface. It has covered with scanty grass surface of the following area in the Figure, where Manning's roughness coefficient, n=0.10.



a. 11 min
b. 7 min
c. 15 min
d. 5 min

28. SOLUTION:

Where, Time concentration of sheet flow= Tc

$Tc=[0.091(nL)^{0.8}]/[(P_2)^{0.5}\ S^{0.4}]$ Metric Units

L=100 Meter
n=0.10
P_2 = 2-yr return period, 24-hr duration precipitation=225 mm
S=Average 2% slope of land surface=0.02

$Tc=[0.091(nL)^{0.8}]/[(P2)^{0.5}\ S^{0.4}]$
$Tc= [0.091(0.10x100)^{0.8}]/[(225)^{0.5}\ (0.02)^{0.4}]=0.1830$ hr

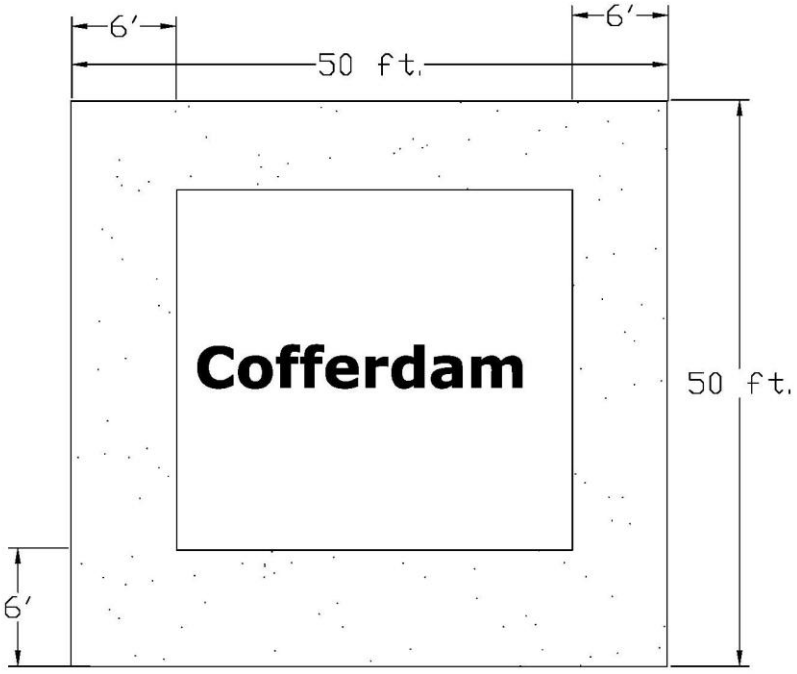
Tc=0.1830 hr x 60=11 min.

The Correct Answer is: (a)

Note: Sheet flow, $Tc=[0.007(nL)^{0.8}]/[(P_2)^{0.5}\ S^{0.4}]$ U.S. Units

44. **PROBLEM** (Groundwater flow)

A square cofferdam is 50 ft on each side, and it has placed in the lake to permit dry construction of a bridge pier. The cofferdam consists of two square sheets pile enclosure. The inner enclosure has separated on all sides from the outer one by 6 ft. The bottom of the lake is practically impermeable. The space between the sheet pile has filled with soil that showed a permeability of 0.035 ft/day in a laboratory test. Assuming the sheet pile was not water tight, and the lake surface was 20 ft above the lake bottom. How much water per day has to be pumped from the excavation to keep the cofferdam dry?



a Q =1645.00 gal/day
b Q =2653.00 gal/day
c Q =678.00 gal/day
d. Q =177.00 gal/day

44. SOLUTION:

Coefficient of permeability, k = 0.035 ft /day
Seepage Surface area, A=(50-12) x 4 x20= 3040 ft^2

H=20 ft
L=6ft
i=H/L=20/6=3.33
Q=VA=KiA=.035 x 3.33 x 3040=354.66 ft^3/day
Q =354.66 x 7.48=2652.90 gal/day (1 ft^3=7.48 gal)

The Correct Answer is: (b)

73. PROBLEM (Disinfect)

A chlorine pump of a water treatment plant is feeding 12% bleach at a dosage of 6 mg/L. If 2,500,000 gallons are treating in 18 hours, how many gallons of bleach per hour are required where, thes pecific gravity of the bleach is 1.15.?

a. 4.0 gal/hrs
b.5.0 gal/hrs
c. 6.0 gal/hrs
d. 7.0 gal/hrs

73. SOLUTION:

Where,

Q=2,500,000 gallons = 2.5MG
Bleach %=12% = 0.12 & Specific gravity of the bleach=1.15
Using, 8.34 lbs/gal
Amount of chlorine=6.0 x 2.5 x 8.34 = 125.1 lbs

Amount of Bleach=125/0.12=1042.5 lbs
Weight of bleach=1.15 x 8.34 = 9.59 lbs/gal
Total Bleach=1042.5/9.59=108.70 gal

Total amount of bleach required per hour =108.7/18=6.03 gal/hrs

The Correct Answer is: (c)

80. PROBLEM (Economics Analysis)

A running construction project is an investment of $200,000. The project has forecasted to create revenues of $50,000 in the first year after the end of the project and of $80,000 in each of the two following years.
What is true for the net present value (NPV) of the project over the three years cycle at a discount/interest rate of 12%?

a) The project NPV is positive that create the attractive.
b) The project NPV is positive, that create the unattractive.
c) The project NPV is negative, that create the attractive.
d) The project NPV is negative, that create the unattractive.

80. SOLUTION:

Calculating Present Values, $PV=FV/(1+r)^n$
Where, Future Value=FV, Interest rate=r, and n=number of year
NPV=SUM(PV)

Construction project

			Cash out	Cash inflow, Present value	Cash inflow, future values	PV	NPV
Interest	period	0	$200,000.00	$0.00	-$200,000.00	-$200,000.00	-$34,639.21
12%	Year	1		$50,000.00	$50,000.00	$44,642.86	
	Year	2		$80,000.00	$80,000.00	$63,775.51	
	Year	3		$80,000.00	$80,000.00	$56,942.42	

Revenue (3yrs)=	$210,000.00
Net revenue (3yrs)=	-$34,639.21

The Correct Answer is: (d)