# CEismic Engineering Question Bank

**BWDB-2026**

**Post: Assistant Engineer (Civil)**

**Venue: BUET**

**Date: 26/06/2026 (10:00 am to 11:00 am)**

**Non Dept: 30 (30 MCQ); Dept: 40 (10 Questions)**

**1. A farmer prepared his land having an area of 1 hectare at the beginning of March, sowed the seeds in the middle of March, and harvested the crop in the middle of May. The irrigation interval is 10 days, and the depth of water applied in each irrigation is 5 cm. Determine the duty of water and the total volume of water applied per hectare during the base period. [CEismic Handnote: Sub: IHF, Lec-3, Page-03]**

**Solution:**

| | |
|---|---|
| Here the base period will be the mid of March to the mid of May.<br>Now we get, for base period-<br>16th March to 31st March = 16 days<br>1st April to 30th April = 30 days<br>1st May to 15th May = 15 days<br>So Base Period, B = 17+30+15 = 61 days<br><br>Given, Irrigation frequency is 5cm/10 days | So total depth of water applied during the base period or delta, $\Delta = \frac{61}{10} \times 5 = 30.5\ cm$<br>Now the duty of water,<br>$D = \frac{8.64B}{\Delta} = \frac{8.64\times61}{0.305} = 1728\ ha/cumec$ **(Ans)**<br><br>Now the total volume of water applied per hectare during the base period is-<br>$V = \frac{A}{D} \times B = \frac{1\times61\times86400}{1728} = 3050\ m^3/ha$ **(Ans)** |

**2. A pipeline has a pressure loss of 0.115 psi per ft of length. Determine the corresponding pressure head loss (in ft) over a length of 1000 ft. (2 Marks) [BUET Class Lecture]**

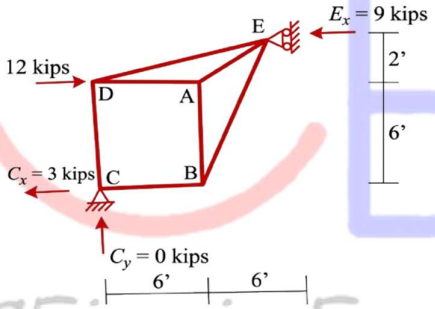
**Solution:**

Assuming the fitting friction to be equal to a 50% increase in actual length, the corresponding pressure loss over the length of the pipe is-

$h_p = 1.5 \times Length\ of\ Pipe \times Pressure\ loss\ per\ ft$

$\Rightarrow h_p = 1.5 \times 1000 \times 0.115 = 172.5\ psi = \frac{172.5\times144}{62.4} ft = 398.08\ ft$ **(Ans)**

**3. The following plane truss is given. Find out the member force $F_{AB}$--**




**Truss analysis basics in CEismic Handnote and Class lectures**

**$F_{AB}$ __4__ kips.**

**Comment the member condition: ☐Tension or, ☑Compression**

**Calculation:**

At joint C:

$\sum Fx = 0$

$\Rightarrow -3 + F_{CB} = 0$

$\Rightarrow F_{CB} = 3\ kips\ (T)$

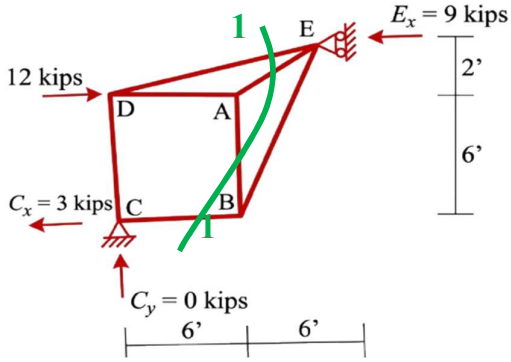
By taking the Right portion of section (1-1):

$\sum M_E = 0$ (CW +ve)

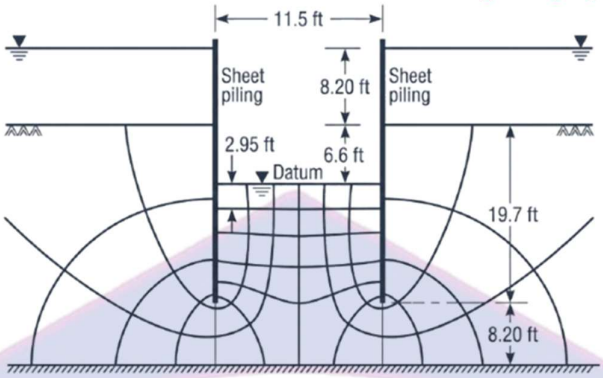
$\Rightarrow F_{BC} \times 8 + F_{BA} \times 6 = 0$

$\Rightarrow 3 \times 8 + F_{BA} \times 6 = 0$

$\Rightarrow F_{BA} = -4\ kips\ (C) = F_{AB}$



**4. Two lines of sheet piles were driven in a river bed as shown in the following figure. The depth of water over the river bed is 8.20 ft. The trench level within the sheet piles is 6.6 ft below the river bed. The water level within the sheet piles is kept at trench level by resorting to pumping. If a quantity of water flowing into the trench from outside is 3.23 ft³/hour per foot length of sheet pile, what is the hydraulic conductivity of the sand? What is the hydraulic gradient immediately below the trench bed? [CEismic Handnote: Sub:Geotech, Chap:Seepage and Flow Net, Page:21]**




**Solution**:

Here, the differential head between the bottom of trench and the water level in the river is, h = 8.20+6.60 =14.80 ft.
Number of flow channels, $N_f$ = 6 and
Number of equipotential drops, $N_d$ = 10

Now we get, $q = k\frac{N_f}{N_d}h$
$\Rightarrow \frac{3.23}{60\times60} = k \times \frac{6}{10} \times 14.8$
$\Rightarrow k = 1 \times 10^{-4} ft/sec$ (Ans)

Again, the distance between the last two equipotential line is given as, $\Delta s$ = 2.95 ft.
[এখানে Equipotential Line দুইটা এর মধ্যবর্তী দূরত্ব টা আসলে একটা Drop এর দূরত্ব নির্দেশ করে। এখানে Drop হয়েছে টোটাল ১০ টা।]
So the required hydraulic gradient-
$i = \frac{\Delta h}{\Delta s} = \frac{14.8}{10\times2.95} = 0.05$ (Ans)
Now check:
$FS = \frac{i_c}{i} = \frac{1}{0.5} = 2 < 5$ to 6.
Which is normally required for sand.

**5. A 6m thick soil stratum has double drainage. The coefficient of consolidation $2.5 \times 10^{-3}\ cm^2/hr$. Find the time required for 50% and 90% consolidation. [CEismic Handnote: Sub:Geotech, Chap: Consolidation and Settlement, Page: 51 & 55]**

**Solution:**

Given, $C_v = 2.5 \times 10^{-3}\ cm^2/hr$
And $H_{dr} = \frac{6}{2} = 3m$ (For double drainage)
**For 50% Consolidation:**
Time factor, $T_v = 0.197$
Now we get-
$T_v = \frac{C_v t_{50}}{H_{dr}^2}$
$\Rightarrow 0.197 = \frac{2.5\times10^{-3}\times t_{50}}{3\times100}$
$\Rightarrow t_{50} = 23640hr = 985days = 2.698yr$ (Ans)

**For 90% Consolidation:**
Time factor, $T_v = 0.848$
Now we get, $T_v = \frac{C_v t_{90}}{H_{dr}^2}$
$\Rightarrow 0.848 = \frac{2.5\times10^{-3}\times t_{90}}{3\times100}$
$\Rightarrow t_{50} = 1017600hr$
$\Rightarrow t_{50} = 42400days = 116.164yr$ (Ans)
[Note: 50% এবং 90% consolidation এর জন্য $T_v$ এর মান মুখস্ত রাখবেন। এতে সময় কম লাগবে।]

**6. Write Four biological wastewater treatment methods for domestic wastewater. (2 Marks) [CEismic Handnote: Sub: Environment, Folder: Selected lectures of BUET]**

**Solution**:

1. Activated Sludge Process (ASP)
2. Trickling Filters
3. Stabilization Ponds/Oxidation Ponds/Lagoons
4. Moving Bed Biofilm Reactor (MBBR)

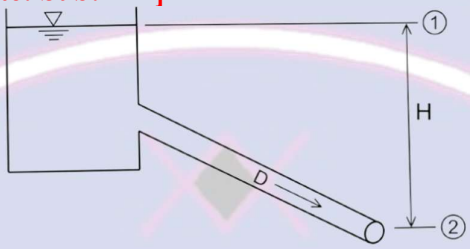
**7. Determine the scum volume and sludge volume of a septic tank designed for 10 persons with a water consumption rate of 75 liters per capita per day (lpcd) for a design period of 3 years.**

**Assume the sludge accumulation rate for digested sludge is 0.06 m³/person/year. [CEismic Handnote: Sub: Environment, Folder: Selected lectures of BUET]**

**Solution:**

| | |
|---|---|
| Given, Design period, N = 3 yrs<br>Number of persons, P = 10 Nos<br>Water Consumption, Q = 75 lpcd<br>Accumulation rate, C = 0.06 m³/person/year<br>(a) Volume of sludge ($V_s$):<br>$V_s = CPN = 0.06 \times 10 \times 3 = 1.8\, m^3$ | (b) Volume of scum ($V_{sc}$):<br>We know, Scum accumulation rate is 30 to 40% of sludge accumulation rate.<br><br>Now take volume of scum = 40 % of $V_s$<br>So, $V_{sc} = 0.4V_s = 0.72\, m^3$ |

**8. Water is discharged from a reservoir through a hose pipe 82 m long. The diameter is 8 cm. The pipe discharges freely to atmosphere at a point 4.3 m below the reservoir free surface. Assuming the exit from the reservoir into the pipe is sharp, calculate the discharge assuming that the pipe friction factor is f = 0.0186, kinematic coefficient 1.2 and dynamic viscosity is $1.002 \times 10^{-3} kg/m.s$. Determine the flow in liter per minute. Neglect entrance loss. [Similar Types of Math in the CEismic Handnote: Sub: FM]**




**Solution:**

Applying Bernoulli's equation between sec 1 and 2, we get-

$$z_1 + \frac{p_1}{\gamma} + \alpha\frac{v_1^2}{2g} = z_2 + \frac{p_2}{\gamma} + \alpha\frac{v_2^2}{2g} + h_L$$

$$\Rightarrow 4.3 + 0 + 0 = 0 + 0 + \frac{\alpha Q^2}{2gA_2^2} + \frac{fLv_2^2}{2gd}$$

$$\Rightarrow 4.3 = \frac{\alpha Q^2}{2gA_2^2} + \frac{fL}{2g} \times \frac{Q^2}{A_2^2}$$

$$\Rightarrow 4.3 = \frac{1.2\times Q^2}{2\times 9.81\times(\frac{\pi(0.08)^2}{4})^2} + \frac{0.0186\times 82}{2\times 9.81\times 0.08} \times \frac{Q^2}{(\frac{\pi(0.08)^2}{4})^2}$$

$$\Rightarrow Q = 0.01026 m^3/s = 615.6\, L/min \text{ (Ans)}$$

**9. A storm with a uniform intensity of 90 mm rainfall occurred over a duration of 8 hours. The initial loss is estimated at 12 mm, and the constant loss is 3 mm/hour. Given a 4-hour Unit Hydrograph (UH) for the catchment, determine the 8-hour flood hydrograph resulting from this storm.**

| **Time (hr)** | **0** | **4** | **8** | **12** | **16** | **20** | **24** |
|---|---|---|---|---|---|---|---|
| **Ordinate of 4h-UH** | **0** | **20** | **50** | **80** | **60** | **30** | **0** |

**[CEismic Handnote: Sub: IHF, Foundation Course IHF Quiz-2: Q-9]**

**Solution:**

Here the total time of rainfall = 24 hours

Total loss over a duration of 8 hours = 12 + 3x8 = 36 mm

Effective rainfall over a duration of 8 hours = 90 – 36 = 54 mm

So, the intensity of this uniform effective rainfall = $\frac{54}{8}$ = 6.75 mm/hr = 27 mm/4 hr = 2.7 cm/4 hr.

| Time Interval (h) | 0 to 4 | 4 to 8 |
|---|---|---|
| Effective Rainfall (cm) | 2.7 | 2.7 |

| Time (hr) | Ordinate of 4h-UH | DRH due to Effective Rainfall | | 8h Flood Hydrograph |
|---|---|---|---|---|
| | | (4 h-UH) × 2.7 | (Lagged by 4 h) × 2.7 | |

| | | | | |
|---|---|---|---|---|
| 0 | 0 | 0 | - | 0 |
| 4 | 20 | 54 | 0 | 54 |
| 8 | 50 | 135 | 54 | 189 |
| 12 | 80 | 216 | 135 | 351 |
| 16 | 60 | 162 | 216 | 378 |
| 20 | 30 | 81 | 162 | 243 |
| 24 | 0 | 0 | 81 | 81 |
| 28 | - | - | 0 | 0 |

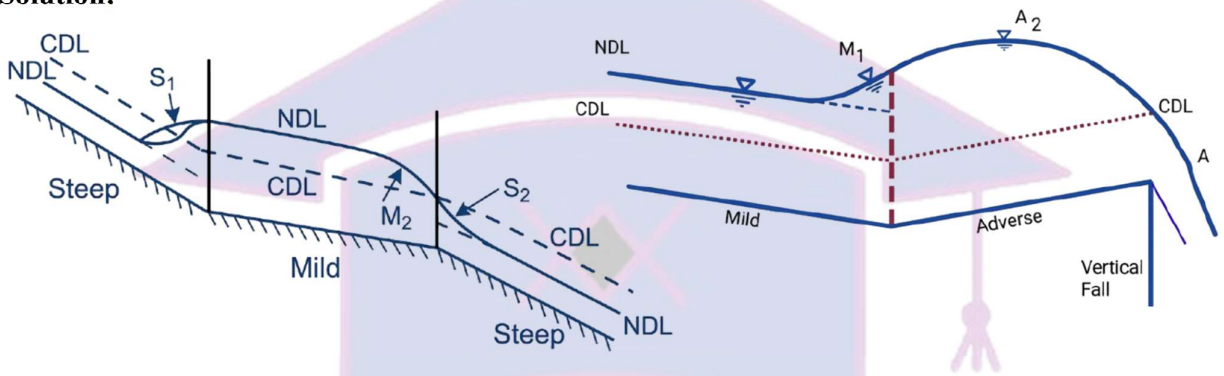
**10. Draw the following flow profiles:**

**a) Steep Mild Steep**

**b) Mild Slope-Adverse Slope-Vertical Fall.**

**[CEismic Handnote: Sub: OCF, Lec-5]**

**Solution:**




**Q-11: A laboratory test was conducted on a 70-60 grade labeled bitumen sample. The measured properties of the sample were compared with the standard requirements of ASTM D946. A comparative chart of the test results and standard values is provided below. Determine whether the bitumen sample is authentic and genuine.**

| Property | Test Results | Reference Values | |
|---|---|---|---|
| | | Minimum | Maximum |
| Penetration at 77°F (25°C) 100 g, 5 s | 66 | 60 | 70 |
| Softening Point, °F (°C) | 48 | 115(46) | |
| Flash point, °F (Cleveland open cup) | 266 | 450 | |
| Ductility at 77°F (25°C) 5 cm/min, cm | 100 | 100 | |
| Solubility in trichloroethylene, % | 99.90 | 99.00 | |
| Retained penetration after thin-film oven test, % | 60 | 52 | |
| Ductility at 77°F (25°C) 5 cm/min, cm after thin-film oven test | 52 | 50 | |

**Solution:**

| Property | Test Results | Reference Values | | Remarks |
|---|---|---|---|---|
| | | Minimum | Maximum | |
| Penetration at 77°F (25°C) 100 g, 5 s | 66 | 60 | 70 | **Passed** |
| Softening Point, °F (°C) | 48 | 115(46) | -- | **Passed** |
| Flash point, °F (Cleveland open cup) | 266 | 450 | -- | **Passed** |
| Ductility at 77°F (25°C) 5 cm/min, cm | 100 | 100 | -- | **Passed** |
| Solubility in trichloroethylene, % | 99.80 | 99.00 | -- | **Failed** |
| Retained penetration after thin-film oven test, % | 60 | 52 | -- | **Passed** |
| Ductility at 77°F (25°C) 5 cm/min, cm after thin-film oven test | 52 | 50 | -- | **Passed** |

**Comment: So, bitumen sample is not authentic and genuine according to ASTM D946 standards.**