University of Asia Pacific
Department of Civil Engineering
Mid Term Examination Fall 2022
Program: B. Sc. Engineering (Civil)

Course: Structural Engineering I **Course Code: CE 311**

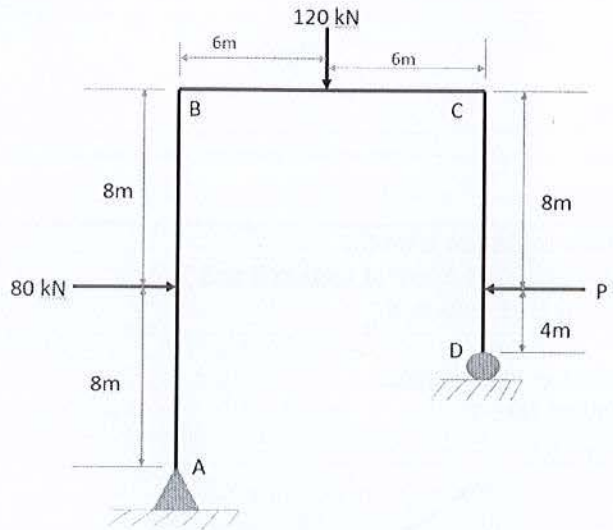
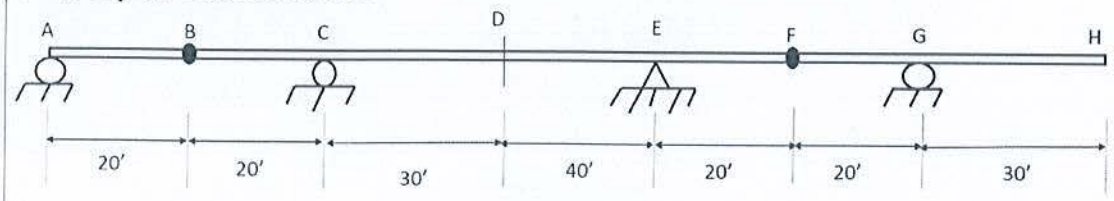
Full Marks: 24+16=40

Time: 1Hour

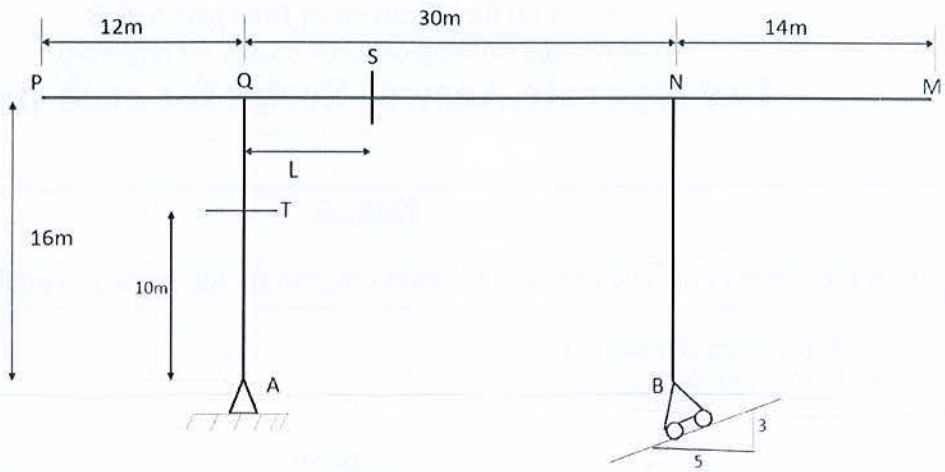
Answer all the Questions of Both part A & B
Assume any missing data reasonably (If required)

Use separate Answer Script for each part

Part– A

1	Draw the Shear Force and Bending Moment diagram for the frame shown in Figure1. P=30 kN for Even Student ID P=48 kN for Odd Student ID  **Figure 1**	**(10)**
2	For the Figure 2, calculate maximum negative shear and maximum bending moment at D due to moving uniform live load of 6 k/ft and moving concentrated live load of P kip. B and F denotes internal hinges. Also draw Influence line for bending moment at E and reaction at E. P=40 kip for Even Student ID P=70 kip for Odd Student ID  **Figure 2**	(14)

Part– B

3(a)	For the Figure 3, Draw Influence Line for Reactions at A and B. Unit Load moves along the top of the beam. L=12m for Even Student ID L=8m for Odd Student ID  **Figure 3**	(6)

(b)	For the Figure 3, Draw Influence Line for a) Bending Moment at section S and T b) Shear at section S Load moves along the top of the beam. L=12m for Even Student ID L=8m for Odd Student ID	(10)

University of Asia Pacific
Department of Civil Engineering
Mid Term Examination Fall 2022
Program: B. Sc. Engineering (Civil)

Course Title: Environment Engineering I — Course Code: CE 331
Time- 1 hour — Full marks: 60

There are **Two** questions. Answer all the questions. *(30*2 = 60)*
[Assume reasonable data if any]

1. (a) Water from River Meghna needs to be treated for distribution purpose. The river has high level of course solids, high turbidity and high suspended solids. Deliver the following: (5+3+4)

i) Complete flow chart with all treatment units to treat the river water to make it safe and ready for distribution without considering any cost or any limitation. Mention which unit of treatment is rendering treatment to which contaminant.

ii) If there is too much algae in the river water, elaborate what change/inclusion would you make in the treatment flow chart?

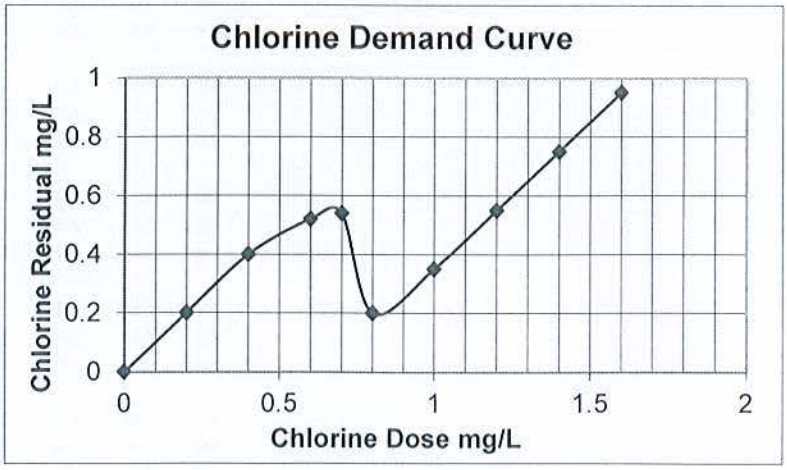
iii) If you need to maintain low cost, maintain less chemical usage, revise the flow chart and justify your new flow chart for each treatment unit.

(b) Explain how you can remove Mg hardness with softening process with necessary reactions if applicable. Elaborate which process of softening is advantageous than the other and in what aspects. Discuss the application benefits of softening process. (5+2+3)

OR

Explain the importance of both rapid mixing and gentle mixing in the coagulation/flocculation process. If sufficient alkalinity is not present in the water to be treated, what is the impact on treatment? Show in a qualitative figure how optimum coagulant dosage is determined using Jar Test.

(c) Please answer the following questions utilizing the Chlorine Demand Curve: (2+4+2)



a) What is the chlorine dose in mg/L for achieving Breakpoint Chlorination?
b) What is the chlorine dose in mg/L to achieve a free residual of 0.25, 0.35, 0.45 and 0.7 mg/L ?
c) If total residual has to be maintained 0.4 mg/L, what is the chlorine dose?

2. (a) Elaborate your understanding on the problems of groundwater development as a potential source of drinking water in Bangladesh mentioning the region of Bangladesh, the problem associated and opportunities for solutions. (10)

(b) Comment on the stability of a raw water sample with the following characteristics: (12)

Total alkalinity = 110 mg/L as $CaCO_3$; Hardness: 120 mg/L as $CaCO_3$; Calcium = 46 mg/L as Ca^{2+}; Magnesium = 1.2 mg/L as Mg^{2+}; TDS = 250 mg/L; pH = 8.2; Temperature = 30°C

Utilize the equation of the Langelier Saturation Index (LI) as follows:

$LI = pH - pH_s$

Where $pH_s = (pK_2 - pK_s) + pCa^{2+} + pAlk$

$pK_2 - pK_S$ = constants based on the ionic strength and TDS of water

pCa^{2+} = negative logarithm of Calcium ion in moles/liter

$pAlk$ = negative logarithm of total alkalinity in equivalents/liter

The necessary table is attached.

(c) Explain the relationship among specific retention, porosity and specific yield. Discuss the formation of the cone of depression in flow towards wells relating Darcy's law. (8)

OR

A 100 mm diameter tubewell is sunk 35 m below static groundwater level. The depth of water in the tubewell while pumping is 33m. The radius of drawdown is 30 m and the coefficient of permeability of the aquifer is 0.5 l/s/m^2. Calculate the probable discharge and specific capacity of the well.

Given Formula:

$Q = \{\pi k (D^2 - d^2)\} / \{\log_e (R/r)\}$.

Sp. Capacity= Discharge of well / Drawdown

TDS, mg/L	$pK_2 - pK_s$ 0°C	10°C	20°C	30°C	40°C	50°C	60°C
	2.45	2.23	2.02	1.86	1.68	1.52	1.08
40	2.58	2.36	2.15	1.99	1.81	1.65	1.21
80	2.62	2.40	2.19	2.03	1.85	1.69	1.25
120	2.66	2.44	2.23	2.07	1.89	1.73	1.29
160	2.68	2.46	2.25	2.09	1.91	1.75	1.31
200	2.71	2.49	2.28	2.12	1.94	1.78	1.34
240	2.74	2.52	2.31	2.15	1.97	1.81	1.37
280	2.76	2.54	2.33	2.17	1.99	1.83	1.39
320	2.78	2.56	2.35	2.19	2.01	1.85	1.41
360	2.79	2.57	2.36	2.20	2.02	1.86	1.42
400	2.81	2.59	2.38	2.22	2.04	1.88	1.44
440	2.83	2.61	2.40	2.24	2.06	1.90	1.46
480	2.84	2.62	2.41	2.25	2.07	1.91	1.47
520	2.86	2.64	2.43	2.27	2.09	1.93	1.49
560	2.87	2.65	2.44	2.28	2.10	1.94	1.50
600	2.88	2.66	2.45	2.29	2.11	1.95	1.51
640	2.90	2.68	2.47	2.31	2.13	1.97	1.53
680	2.91	2.69	2.48	2.32	2.14	1.98	1.54
720	2.92	2.70	2.49	2.33	2.15	1.99	1.55
760	2.92	2.70	2.49	2.33	2.15	1.99	1.55
800	2.93	2.71	2.50	2.34	2.16	2.00	1.56

University of Asia Pacific
Department of Civil Engineering
Midterm Examination Fall 2022
Program: B.Sc. Engineering (Civil)

Course Title: Open Channel Flow | Course Code: CE 361

Time: 1 hour | Credit Hour: 3.00 | Full Marks: 40

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1. ***Table 1*** shows the velocity measurements along a vertical in a wide channel where u is the velocity at a distance z from the channel bottom. Using the trapezoidal rule of numerical integration, compute the discharge per unit width, the state of flow, and the velocity distribution coefficients. The total depth of flow is 9 m. **(12)**

Table 1

z (m)	0	1.5	3	4.5	6	7.5	9
u (m/s)	0	3.13	3.62	4.035	4.51	5.095	5.68

2. An engineer was assigned to design a trapezoidal channel that would carry a discharge of 50 m^3/s. He chose the channel's bottom width as 6 m, the kinetic energy coefficient value as 1.05, and the side slope as 1.5H:1V. For the critical depth of flow of the channel, he initially assumed a value of 2 m. However, it was later changed to a new value after using the bisection method with 6 iterations. Determine the finally chosen critical depth of flow and the velocity of the channel. **(10)**

3. In a rural area, a triangular channel is used to transport water from a reservoir to a cornfield. During a flooding event in 2022, the channel became filled with coarse debris particles and so its boundary became really rough. Currently, the median diameter of the channel bed materials is 4 mm and the side slope is 1.5H:1V. Considering the channel has a critical flow at a depth of 1.5 m, compute i) Manning's n, Chezy's C, friction factor f, ii) the bed slope, iii) the drag velocity, and iv) the value of k_s **(12)**

4. A spillway flip bucket has a radius of curvature of 15 m. The depth of flow of section A-A (shown in ***Figure 1***) is 4 m and the discharge per unit width is 75 m^3/s. Determine the pressure at O. **(2)**

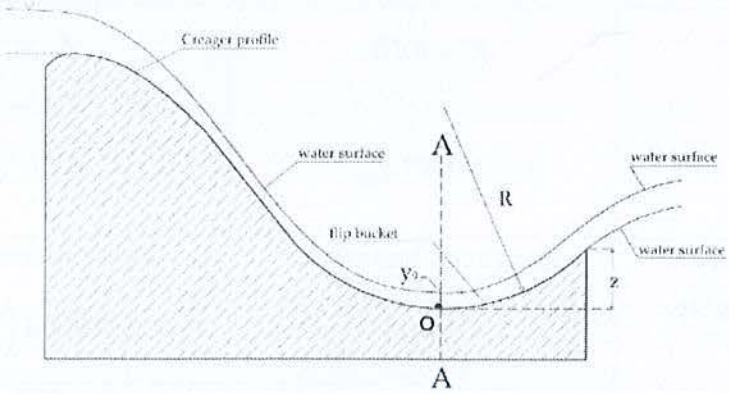


Figure 1

5. Prove that the specific energy in the critical state of a rectangular channel is 1.5 times its depth of flow. **(4)**

Necessary Equations:

Triangular channel	Trapezoidal channel	Circular Channel
$A = (sh)h$	$A = (b + sh)h$	$h = \frac{d_o}{2}\left[1 - cos\frac{\omega}{2}\right]$
$P = 2h\sqrt{1 + s^2}$	$P = b + 2h\sqrt{1 + s^2}$	$\omega = 2cos^{-1}\left(1 - \frac{2h}{d_o}\right)$
$B = 2sh$	$B = b + 2sh$	$A = (\omega - sin\omega)\frac{d_o^2}{8}$
Rectangular Channel		$B = d_o \sin\frac{\omega}{2}$
A = bh		$P = \frac{\omega d_o}{2}$
P= b + 2h		*Note that ω is in radian*

$Q = U_1A_1 = U_2A_2$	$F_r = \frac{U}{\sqrt{gD}}$	$R_e = \frac{UR}{\upsilon}$
$\alpha = \frac{\sum u^3 \Delta A}{U^3 A}$	$\beta = \frac{\sum u^2 \Delta A}{U^2 A}$	$p = \gamma h\left(1 \pm \frac{U^2}{gr}\right)$
$E = h + \frac{\alpha U^2}{2g}$	$Z = A\sqrt{D}$	$Z_c = \frac{Q}{\sqrt{g/\alpha}}$
$h_c = \sqrt[5]{\frac{2\alpha Q^2}{gs^2}}$	$n = 0.047{d_{50}}^{1/6}$	$u^* = \sqrt{gRS_o}$
For smooth boundary: $\frac{U}{u^*} = 5.75log\left(\frac{3.64u^*R}{\upsilon}\right)$	**For rough boundary:** $\frac{U}{u^*} = 5.75log\left(\frac{12.2R}{k_s}\right)$	**For transition boundary:** $\frac{U}{u^*} = 5.75log\left(\frac{12.2R}{k_s + 3.35\upsilon/u^*}\right)$
$Q = CAR^{1/2}{S_f}^{1/2}$	$Q = \frac{1}{n}AR^{2/3}{S_f}^{1/2}$	$Q = \sqrt{\frac{8g}{f}}AR^{1/2}{S_f}^{1/2}$

University of Asia Pacific
Department of Civil Engineering
Midterm Examination, Fall 2022
Program: B.Sc. Engineering (Civil)

Course Title: Principles of Accounting | Course Code: ACN 301
Time: 1 hour | Credit Hour: 2 | Full Marks: 20

Answer all the questions

1. Explain why dividend is not an expense. Discuss different types of economic entities. **(2 + 2 = 4)**

2. David started his own consulting firm, David Consulting on June, 2021. The following transactions occurred during the month of June.

June 1 David invested $6,000 cash in business.
2 Paid $700 for office rent for the month.
5 Received $3,000 cash for services performed.
8 Withdrew $2,000 cash for personal use.
12 Purchased $600 of supplies on account.
16 Performed $4,400 of services on account.
20 Made a partial payment of $400 for the supplies purchased on account on June 12.
25 Borrowed $5,000 from the bank on a note payable.
27 Received a cash payment of $3,000 for services performed on account on June 16.
30 Paid $280 for utilities.

Show the effects of the previous transactions on the accounting equation using the following format: **(6)**

	Assets					Liabilities		Owner's Equity			
Date	Cash	+ Accounts Receivable	+ Supplies	+ Equipment	=	Notes Payable	+ Accounts Payable	+ Owner's Capital	- Owner's Drawings	+ Revenues	- Expenses

3. Stan Ley opened a "Zip Line" adventure park on May 1, 2020. The following transactions occurred in the first month of operations:

May 1 Stan invested $2,000 cash in the business.
2 Purchased equipment of $16,000 on account.
5 The company borrowed $25,000 cash from Lloyds bank on a note payable.
8 Purchased insurance for the year and paid $6,000 cash.
9 Paid off equipment purchased on May 2.

14 Took first group through an adventure tour and collected $1,000 cash.
18 Received but did not pay the telephone bill of $200.
20 Hired a manager with a salary of $8000 per month, effective on June 1.
25 Took another tour group out and billed the group $2,000. Payment is due on June 10.
30 Paid interest of $200 on the note payable.

a) Prepare a journal for the transactions. **(5)**

b) Post it to the ledger accounts. **(5)**

University of Asia Pacific
Department of Civil Engineering
Midterm Examination Fall-2022
Program: B.Sc. Engineering (Civil)

Course Title: **Geotechnical Engineering I** Course Code: **CE 341**
Time: 1 hour Credit Hour: 3.0 Full Marks: 60

[Answer all the questions. Digits in the right margin inside the 1st parentheses indicate marks]

1. For a given sandy soil the maximum and minimum void ratios are 0.72 and 0.46, respectively. If *Gs* = 2.71 and the degrees of saturation of soil is 64.14%, what is the moist unit weight of compaction (kN/m³) in the field if the relative density of the soil is 82%? Also calculate the saturated and submerged unit weight of the given soil sample. (10)

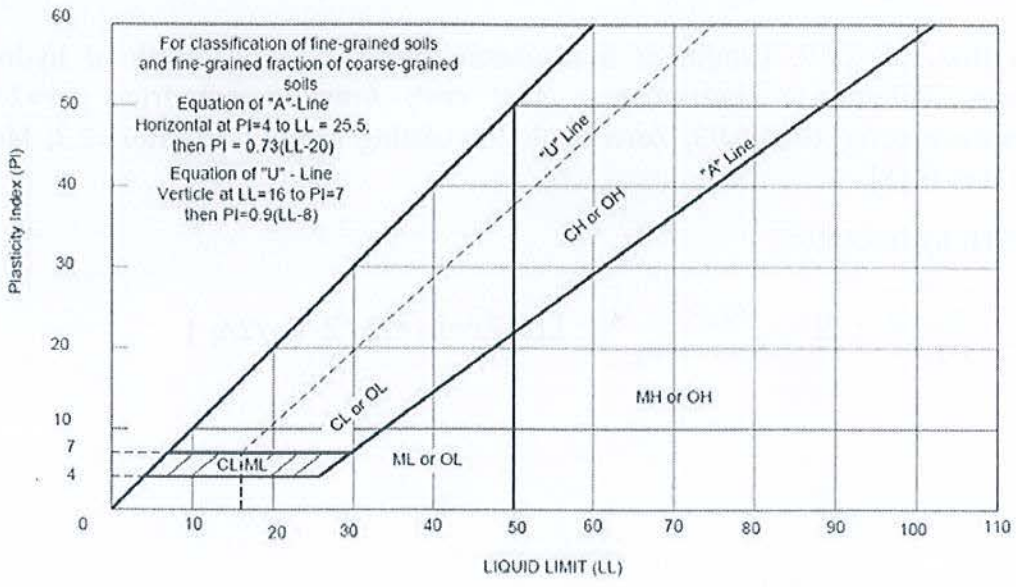
2. Write short note on ___ (6+2+2=10)

   a. Glacier transported soil.
   b. Peat soil.
   c. Optimum moisture content in field compaction.

3. <u>The results of the particle-size & plasticity analysis of a soil are as follows:</u>

Percent passing through the No. 4 sieve =73%
Percent passing through the No. 200 sieve =52%
The liquid and plastic limit of the soil are 54% and 28%, respectively; where the oven-dry Liquid limit is 43%.

Mentioning group symbol and group name, classify the soil by the Unified Soil Classification System. (10)



4. The results of a standard Proctor test are given in the following table. (10+10=20)

Moisture content (%)	Moist unit weight (kN/m³)
12	18.30
14	19.30
16	20.0
18	20.30
20	20.1
22	19.80

After compaction of the soil in the field, sand cone test were conducted and the following results were obtained:
Calibrated dry weight of Ottawa sand = 1900kg
Volume of the bottle filled with Ottawa sand = 1.18 m^3

Calibrated mass of Ottawa sand to fill the cone = 0.579 kg
Weight of jar + cone + sand (before use) = 9.32 kg
Weight of jar + cone+ sand (after use) = 6.31 kg
Weight of wet soil from hole = 3.43 kg
Moisture content of wet soil = 29.73 %

a) Determine__ Maximum dry unit weight in laboratory and optimum moisture content.

b) If the specification of this highway project demands 100±5% relative compaction which must be achieved, then verify whether the field compaction meets the demand or not.

5. During hydrometer analysis of a silty clay sample using **151H hydrometer** the reading of the hydrometer observed at elapsed time of 8 minutes is 43. The suspension was prepared using 80gm dry soil sample in 1000cc water. The temperature of lab room at that time was 23°C. If the viscosity and density of water at 23°C is 0.00783poise and 998.31kg/m^3 respectively, then compute the value of particle size(diameter) and percent finer (%) at that specific time.

[Given that, Gs=2.69; Length of hydrometer stem=10.5cm; Length of hydrometer bulb=6cm; Volume of Hydrometer= 47.8 cm^3; Area of cylindrical jar=23.5cm^2; Temperature correction=0.93; Zero or deflocculating agent correction=2.3; Meniscus correction= 0.41] (10)

[For 151H hydrometer,

$D=\sqrt{\frac{18\mu}{(G_S-1)\gamma_\omega}\frac{z_r}{t}}$; $N=\frac{Gs\gamma_\omega VR_c}{10(Gs-1)W_s}\%$; Lor $Zr=L_1+L_2/2-V_H/2A_j$]

University of Asia Pacific
Department of Civil Engineering
Mid Term Examination Fall 2022
Program: B. Sc. in Civil Engineering

Course: Design of Concrete Structures I **Course Code: CE 315**
Time: 1 Hour **Full Marks:60**

Answer all the Questions

Assume any missing data reasonably (If required)

1 a) Explain the differences between **WSD** and **USD** methods of design with particular emphasis on how **safety** is ensured in both the design methods. **(6)**

b) Discuss the variation of strength reduction factor (φ) for flexure, with net tensile strain of steel (ϵ_t), as given in BNBC. (4)

c) Describe the term "**Serviceability**" in RC design. (4)

d) Draw stress and strain distribution figure of **uncracked**, **cracked** and **ultimate conditions** of RC rectangular beam in flexure. **(6)**

2 A simply supported rectangular beam of six meter span carries a uniformly distributed computed dead load (including its self-weight) of 30 kN/m and a service live load of 20 kN/m. The following data can be used in design. **(20)**

Data:

f_y = 414 MPa

f_c' =28 MPa

β_1 = 0.85

φ=0.9

3-1

3 a) A column has a cross section of 400mm x 500mm and is reinforced by 6-25mm bars. **(10)**
Analyze the column to obtain **the axial load** that will stress the concrete to 8MPa.
Given:

f_y = 414 MPa

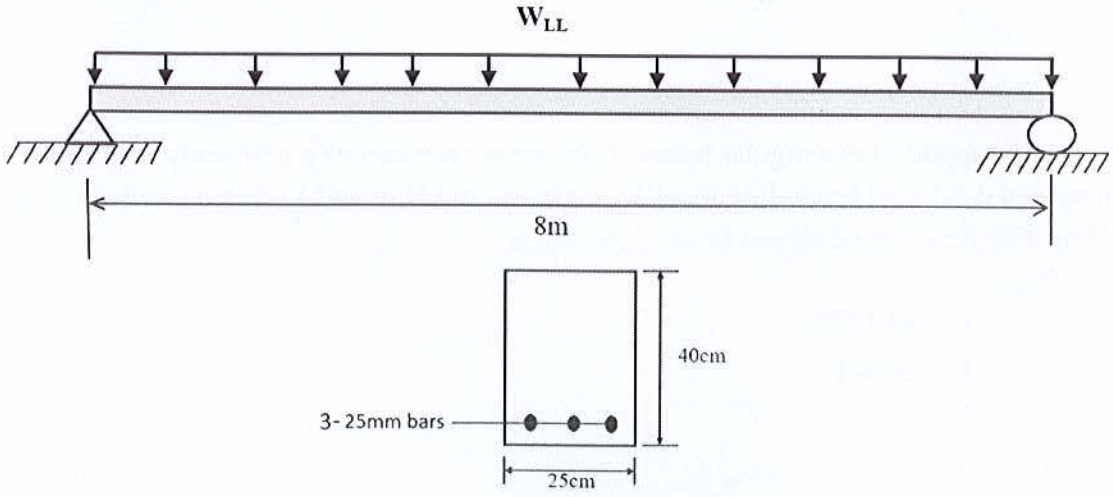
f_c' =28 MPa

E_s =200000 MPa

b) Analyze the section of the beam shown in **Figure 1** to obtain uniformly distributed load **"W_{LL}"** that will produce first tension crack. Consider self-weight of the beam in calculation. **(10)**
Given:

f_y = 414 MPa

f_c' =28 MPa



Cross section of the beam

Figure 1:RC Rectangular Beam