



CINEC Campus
Faculty of Engineering & Technology
Department of Civil Engineering
BSc Hons (Eng) in Civil Engineering
Semester 4 Resit Paper Year II

Module Code	:	CE 2326
Module Title	:	Surveying I
Date	:	02/03/2025
Examiners	:	Ms. L. S. Ranasinghe
Time Allowed	:	3 hrs

INSTRUCTIONS TO CANDIDATES

- This is a **closed book** examination.
- This paper consists of **seven** questions. You should answer **five** questions of your choice.
- Write clearly legibly with a blue or black pen.
- Use only the **CINEC Answering Booklet**. Additional sheets may be requested from the invigilators.
- This paper contains 7 pages.

MATERIALS REQUIRED

- CINEC answering Booklet; Extra answering paper.
- You may use a scientific calculator. This must not be programmable. This may be examined during the examination.

Question 1

- a) Explain the differences between traversing and triangulation in surveying by describing the methods used, their applications, advantages, and disadvantages. (2 marks)
- b) Illustrate the differences between systematic errors and random errors in surveying measurements. (2 marks)
- c) A 30 m steel tape measured 30.0150 m when standardized fully supported under a 70 newton pull at a temperature of 20°C. The tape weighed 0.90 kg (9N) and had a cross-sectional area of 0.028 cm². What is the true length of the recorded distance AB for the following condition?
(Assume all full tape lengths except in the last one, Young's modulus of steel as 207 kN/mm² and the coefficient of linear expansion of steel as 1.15 x 10⁻⁵ m per °C). (16 marks)

Table Q1

Recorded distance	Average temperature	Support	Tension	Elevation difference per 100m
114.095 m	12°C	Suspended	100N	2.5 m

[The correction for the effect of absolute length, temperature, sag, slope, and pull on the length are $L \times \frac{\text{measured length}}{\text{assumed length}}$, $(T_m - T_o)KL$, $\frac{W^2 L^3}{24P^2}$, $\frac{h^2}{2L}$, and $\frac{(P - P_o)L}{AE}$, respectively, in standard notation.

Question 2

- a) A triangular plot of land has a base of 40 cm and a height of 60 cm on a map drawn to a scale of 1 cm: 200 m. A new map is to be drawn at a scale of 1 cm: 400 m. What will be the area of the same plot of land on the new map? (6 marks)
- b) P, Q, R and S are four stations whose coordinates are as shown in Table Q2. Another station X is to be fixed at the intersection of the lines PR and QS. Calculate the coordinates of X. (6 marks)

Table Q2

Station	Easting (m)	Northing (m)
P	850.65	1002.98
Q	1000.00	1000.00
R	1060.98	1156.85
S	1120.50	1006.58

- c) Figure Q2 shows a survey line OABC crossing a lake, where the chainage at O and A are 0.00m and 10.50 m, respectively. A perpendicular to line OABC is drawn from B to the points P and Q located on opposite sides of the lake. If the distance from P to Q is 800m, find the chainage at B. (8 marks)

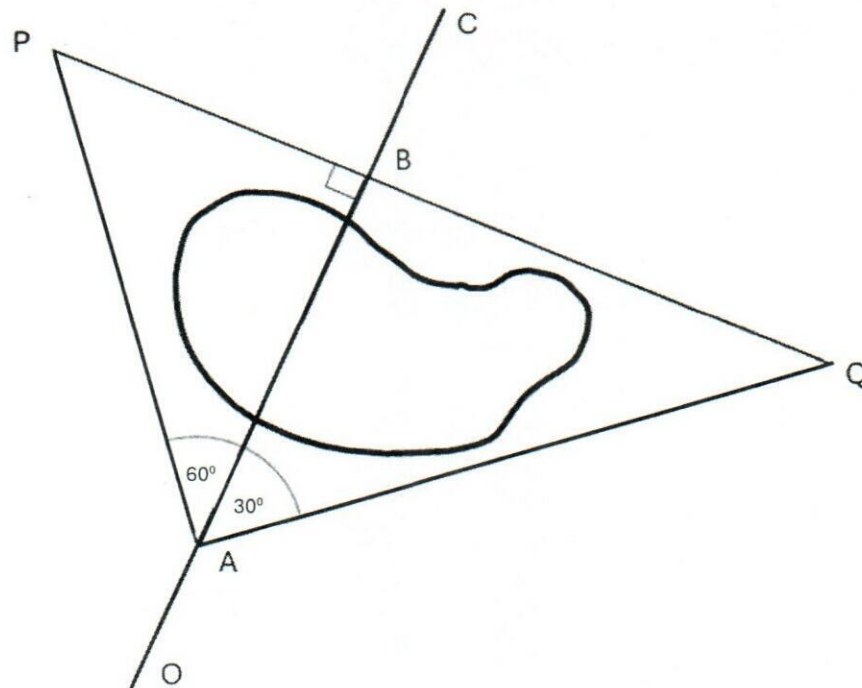


Figure Q2

Question 3

- a) Differentiate between differential levelling and profile levelling. (5 marks)
- b) List and explain any two sources of errors in levelling (5 marks)
- c) Fill in the gaps of the level sheet by finding values from X1 to X10 and A to E. (10 marks)

Table Q3

BS	IS	FS	Rise	Fall	RL	Remarks
A					50.00	BM A
	2.35			B	X1	Kerb
C		3.98		1.63	X2	CP 1
	1.25		1.31		X3	Kerb
	3.65			2.40	46.25	Post
3.49		0.67	D		X4	CP 2
	E		0.91		X5	Kerb
2.64		1.54	1.04		X6	CP 3
	2.95			0.31	X7	Post
		3.78		0.83	X8	BM A
10.01		9.97	6.24	6.20		Σ
		X9		(0.04)	X10	Δ

Question 4

- a) How would you apply the Transit Rule to correct observational errors of a traverse conducted? (5 marks)
- b) The following fore bearings and back bearings were observed in traversing with a compass. Calculate the interior angles and correct them for observational errors.

Table Q4

Line	Fore bearing	Back bearing
PQ	S 37°30' E	N 37°30' W
QR	S 43°15' W	N 44°15' E
RS	N 73°00' W	S 72°15' E
ST	N 12°45' E	S 13°15' W
TP	N 60°00' E	S 59°00' W

- (i) Compute the interior angles at each control point. (5 marks)
- (ii) Correct the traverse for observational errors and calculate the bearing of each line. (10 marks)

Question 5

- a) several errors occur when conducting a traverse. What is a closing error, and how can you minimize it when performing a traverse survey?

(5 marks)

- b) A closed traverse was conducted starting from point A with coordinates (1000.00 mN, 1000.00 mE), and the readings taken are given in Table Q5.

Table Q5

Line	Whole Circle Bearing	Length (m)
AB	0°00'	50.60
BC	63°49'	91.08
CD	89°13'	67.06
DE	160°55'	61.57
EF	264°02'	41.15
FA	258°18'	121.62

Due to a recording error, there is a mistake in the length of one line segment.

- (i) Which line segment is incorrectly recorded, and how much is the correct length?

(5 marks)

- (ii) Calculate the coordinates of points A, B, C, D, E, and F.

(10 marks)

Question 6

- a) Explain the principle of tacheometry by indicating how it differs from direct levelling and chaining in surveying. (5 marks)
- b) Describe the stadia method of tacheometry and list two advantages and two limitations of using this method in civil engineering surveys. (5 marks)
- c) A tacheometer is set up at a station, and the following readings are taken on a staff held vertically at a point:

Table Q6

Top stadia reading	Middle stadia reading	Bottom stadia reading
2.105 m	1.705 m	1.305 m

Given that the tacheometer has a stadia interval factor (multiplication constant) of 100 and an additive constant of 0, calculate:

- i) The horizontal distance between the instrument and the staff. (5 marks)
- ii) The difference in elevation between the instrument axis and the staff station. (5 marks)

Question 7

- a) The following offsets were taken from a chain line to a hedge as given in Table Q7. Compute the area between the chain line, the hedge, and the offset using the trapezoidal rule.

(8 marks)

Table Q7

Distance	0	20	40	60	80	120	160	220	280
Offset	9.4	10.8	13.6	11.2	9.6	8.4	7.5	6.3	4.6

- b) An embankment with a constant width (b), length (L), height (H), and side slope (1: n) must be reconstructed efficiently. Using the cross-section method, find the existing volume of soil in the embankment assuming $b = 10$ m, $L = 25$ m, and $n = 2$ using a suitable method. The height of the embankment (h) given by Figure Q7, is obtained at 5 m intervals.

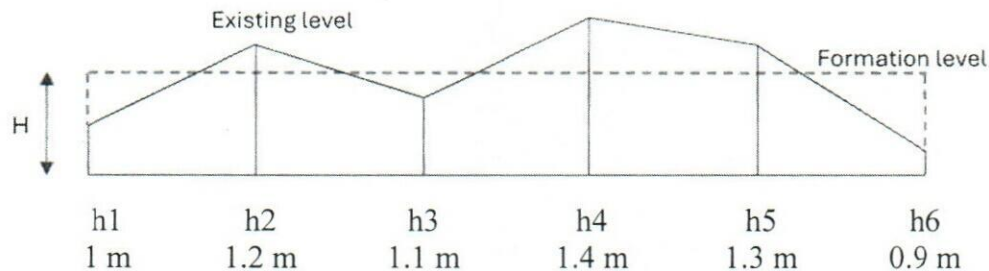


Figure Q7

Propose a formation level (H) to avoid adding or removing soil from the embankment during reconstruction.

(12 marks)



Faculty of Engineering & Technology

Department of Civil Engineering

BSc Hons (Eng) Civil Engineering

Semester 5 Resit - Final Examination 2025

Module Code	:	CE2325
Module Title	:	Soil Mechanics and Engineering Geology I
Date	:	28 th February 2025
Examiners	:	Supun Walpita
Time Allowed	:	3 hrs

Instructions to Candidates:

- This is a **closed** book examination.
- This paper consists of three (03) questions. Answer **all three** questions.
- Use only the answers booklet, additional papers and graph paper for your answers.
- Write clearly and legibly with a blue or black pen.
- Write your name and student number on all sheets.
- Answers to different parts of the same question (other than any graph sheets used) should not be scattered.
- Marks will be deducted for missing or incorrect measuring units.
- You are advised to make a clear diagram for each question, where appropriate. This will help you to perform calculations correctly.
- If You have any doubt regarding the interpretation of the wording of a question, make your own assumptions and clearly state it on the answer script.

1)

- a)
- With the aid of a diagram, illustrate the rock cycle. (4 marks)
 - Identify main rock types and give at least 3 examples for each (3 marks)
 - Explain the terms "transported soil" and "residual soil". (3 marks)

b) The results of particle size analyses of soils A and B are shown in table 01

Table 01

Sieve size /particle size	Percentage Passing	
	Soil A	Soil B
63 mm	100	
20 mm	64	
6.3 mm	39	
2 mm	24	
600µm	12	
212 µm	5	100
63 µm		95
0.020 mm		69
0.006 mm		46
0.002 mm		31

The results of Plastic limit & Liquid limit tests of soil B are shown in Table 02

Table 02

	Liquid limit test				Plastic limit Test	
	Test 01	Test 02	Test 03	Test 04	Test 01	Test 02
Container +Wet soil (g)	33.2	32.1	29.2	33	11.83	15.04
Container +Dry soil (g)	28.2	26.5	22.4	23.9	11.25	13.02
Container (g)	7.02	7.04	7.10	7.02	7.04	7.25
Blow count	10	17	22	32	—	—

- i. Draw Particle size distribution curve and determine the coefficients of uniformity and curvature for soil A (12 marks)
- ii. Determine the Liquid limit, Plastic Limit and Plasticity Index of the soil B (8 marks)
- iii. Comment on the plasticity of the soil B using above indices (2 marks)
- iv. Classify two soils using Unified soil classification system (4 marks)

2)

- a) Discuss how particle size distribution influences the degree of compaction in soil. In your answer, explain the role of gradation, void ratio, and packing efficiency in achieving maximum compaction. (5 marks)
- b) The data shown in table 03 were obtained in a standard laboratory Proctor compaction test. The weight of container is 1100g and its volume is 1000 cm³. ($g = 9.81 \text{ ms}^{-2}$).

Table 03

Attempt	1	2	3	4	5
Mould + wet soil (g)	2800	3241	3285	3221	3100
M/C (%)	8	12	14	16	18

Following are the results obtained from a field unit-weight determination test performed on the same soil by means of the sand cone method:

Calibrated dry density of Ottawa sand = 1570 kg/m³
 Calibrated mass of Ottawa sand to fill the cone = 0.545 kg
 Mass of jar + cone + sand (before use) = 7.59 kg
 Mass of jar + cone + sand (after use) = 4.78 kg
 Mass of moist soil from hole = 3.007 kg
 Moisture content of moist soil = 10.2%

- i. Plot the compaction curve and determine maximum laboratory dry unit weight and optimum water content (10 marks)
 - ii. Calculate Field Dry unit weight. (8 marks)
 - iii. Determine the relative compaction in the field. (2 marks)
- c) A construction project requires a geotechnical site investigation for proposed building. As part of the investigation, you are tasked with determining the soil properties and groundwater conditions.
- i. Describe the key steps involved in a standard geotechnical site investigation. (4 marks)
 - ii. Discuss the different types of soil sampling methods and explain how you would choose the appropriate method for this project. (4 marks)

3)

- a) Explain why falling head is preferred for clay soils over constant head permeability test (4 marks)
- b) Discuss the nature of hydraulic conductivity of a soil with respect to its degree of saturation (4 marks)
- c) During a falling head permeability test, the water in the stand-pipe falls from a height of " h_1 " to a final height " h_2 " in a time interval " t ". Show that the saturated permeability can be expressed as

$$k = \frac{al}{At} \ln \frac{h_1}{h_2}$$

Where,

A = cross-sectional area of sample

a = cross-sectional area of stand pipe

l = length of sample.

(8 marks)

- d) A falling head permeability test was conducted on a sample with a diameter 84mm and length 100mm. The stand pipe diameter was measured as 3.5 mm. If the test was done to a soil which has a saturated permeability of 3×10^{-6} m/s, find what time would be taken for the head to fall from 150 to 100 cm. (7 marks)

- e) Figure 1 shows an aquifer inclined at 10° to the horizontal. The difference of water levels in two observation wells at a horizontal distance of 60 m is 5m. Determine the discharge Through the aquifer per unit width if $k = 0.7$ mm/sec. The depth of aquifer perpendicular to the direction of flow is 2.951m. (8marks)

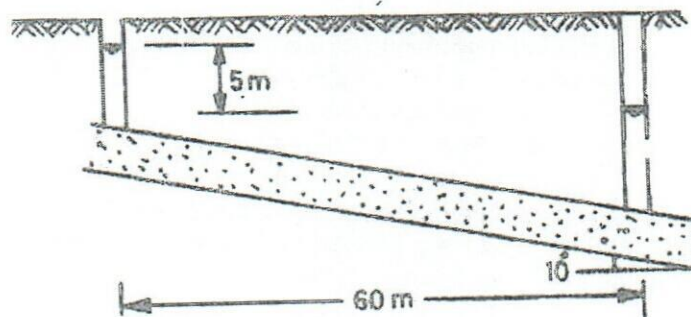
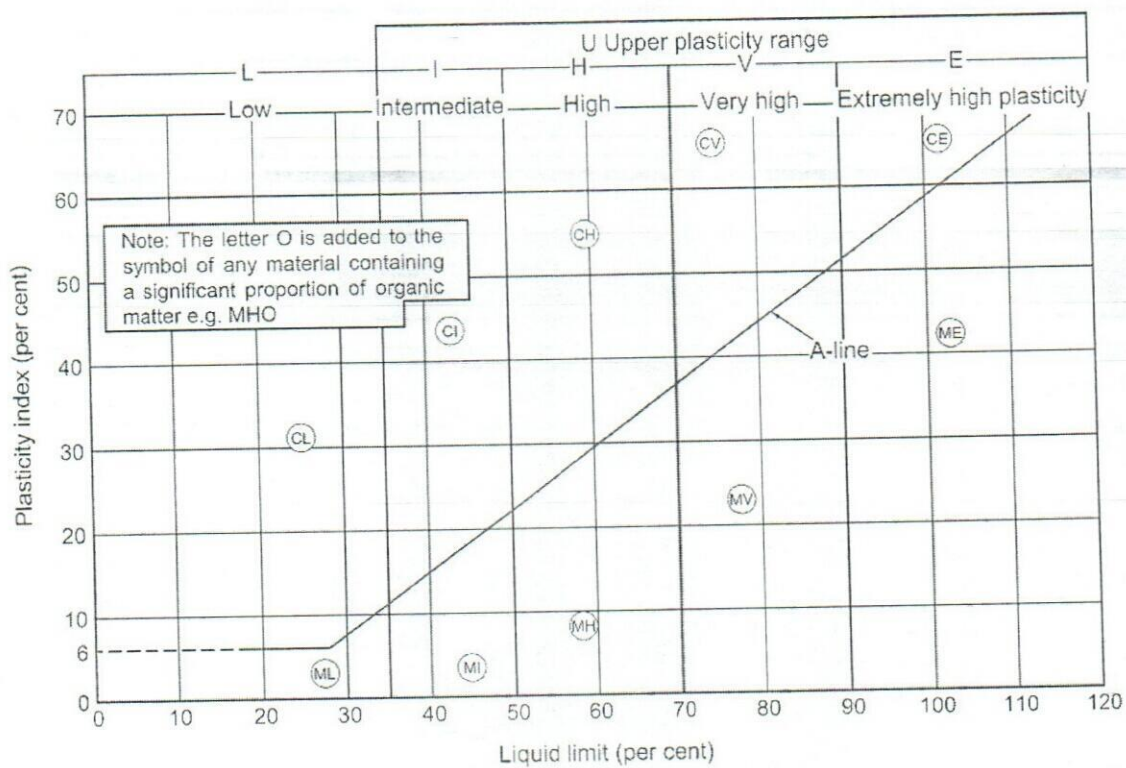
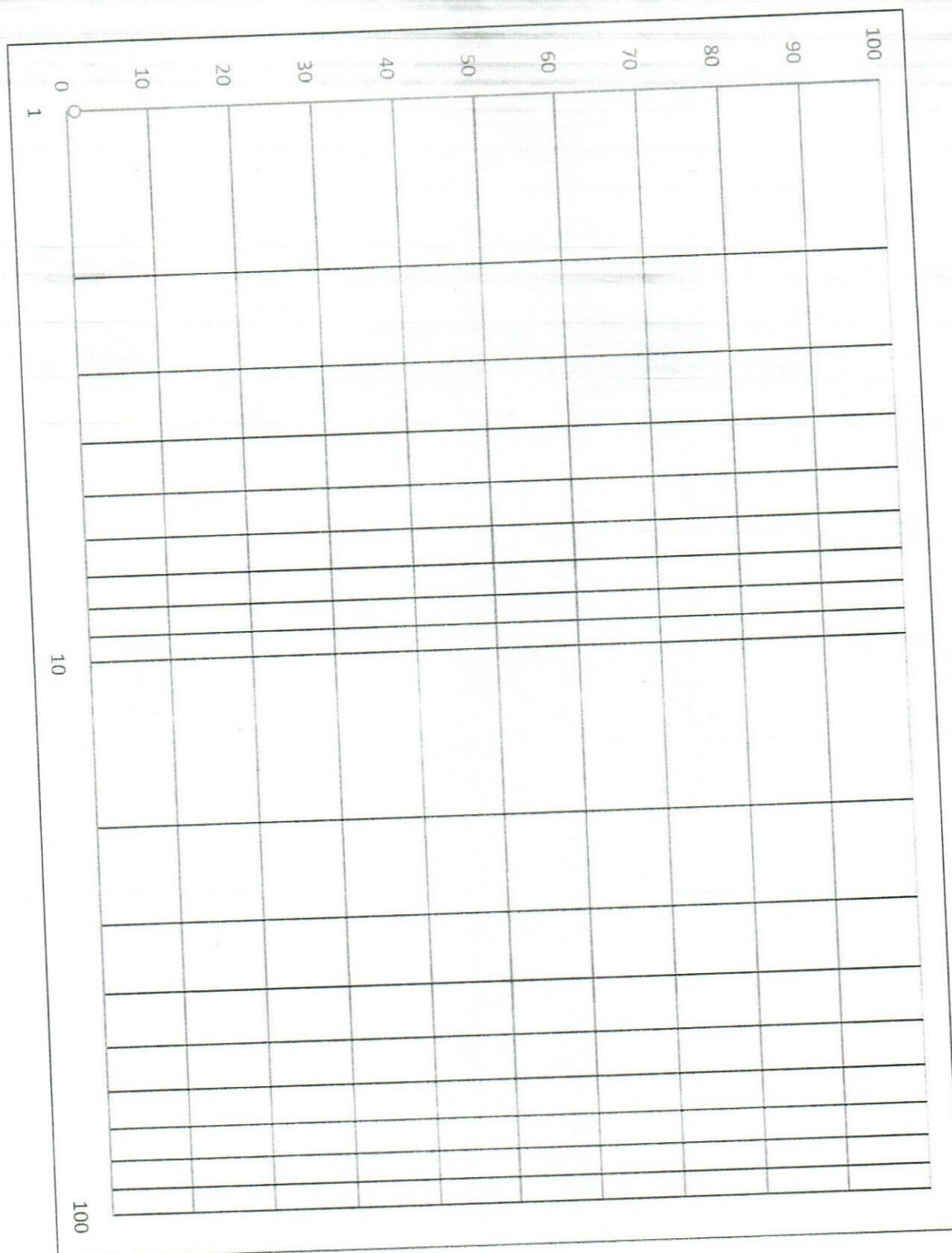


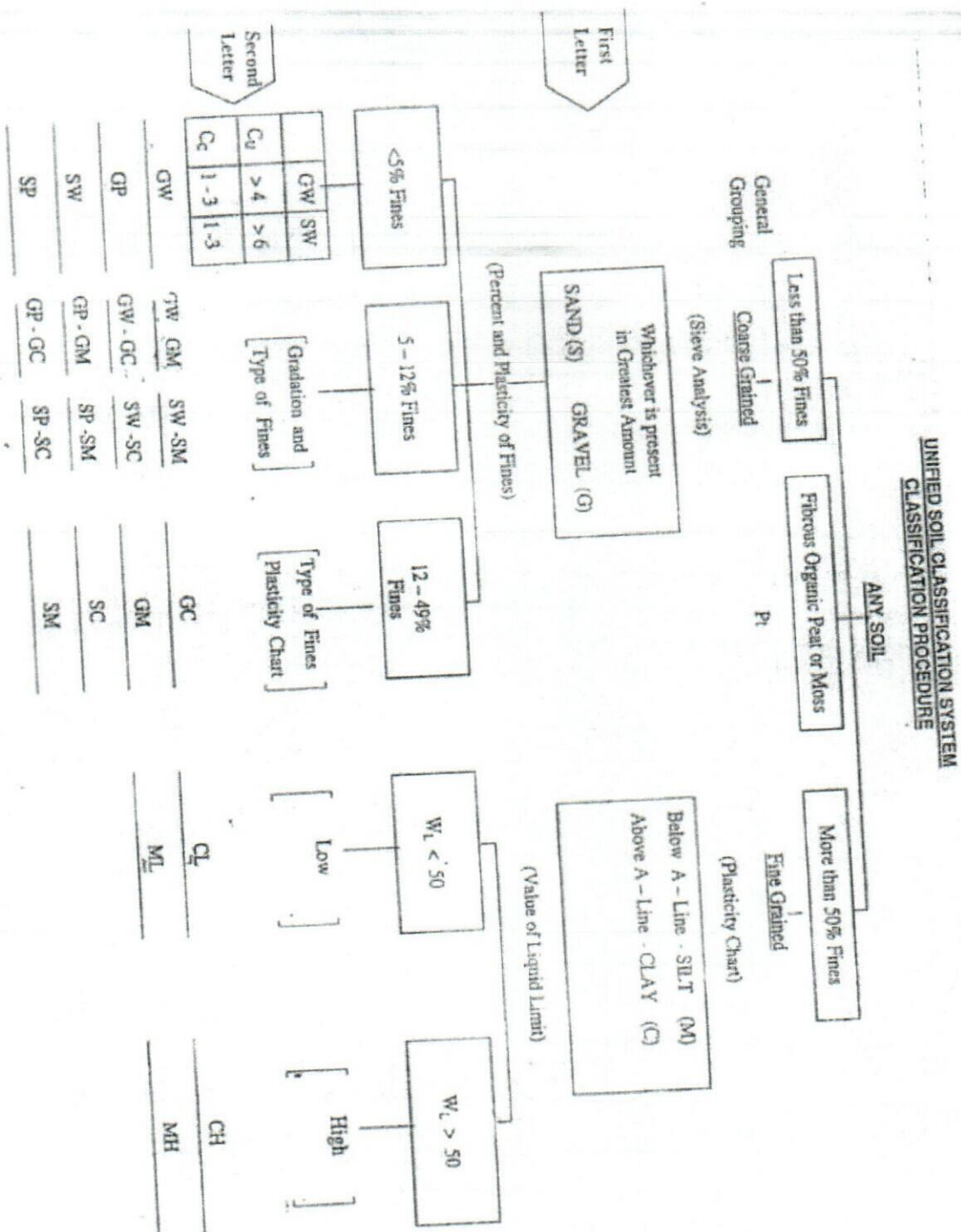
Figure 1

- End of question paper -

Additional Information









Faculty of Engineering & Technology
Department of Civil Engineering
BSc Hons (Eng) Civil Engineering
Semester 4 Re Sit - Final Examination 2025

Module Code	:	CE2324
Module Title	:	Hydrology
Date	:	26 th February 2025
Examiners	:	Ms. Udayanga Edirisooriya
Time Allowed	:	3 hrs

Instructions to Candidates:

- This is a **closed book** examination.
- This paper consists of Six (06) questions. Answer **all six** questions.
- Use only the answers booklet, and additional papers for your answers.
- Write clearly and legibly with a blue or black pen.
- Write your name and student number on all sheets.
- Answers to different parts of the same question should not be scattered.
- Marks will be deducted for missing or incorrect measuring units.
- You are advised to make a clear diagram for each question, where appropriate. This will help you to perform calculations correctly.
- If you have any doubt regarding the interpretation of the wording of a question, make your own assumptions and clearly state it on the answer script.

Question 01**(Total -100 marks)**

Integrated Water Resources Management (IWRM) is a crucial approach in managing water sustainably. The hydrological cycle plays a fundamental role in supporting IWRM by ensuring a continuous movement of water through various processes. Five key aspects of IWRM are:

- Sustainable Water Availability
 - Agricultural Water Management
 - Flood and Drought Mitigation
 - Water Quality Protection
 - Hydropower and Urban Water Supply
- a) Discuss the role of the hydrological cycle in achieving sustainable water management. Explain how different processes contribute to three of the key IWRM aspects mentioned above. Provide real-world or theoretical examples to support your discussion.
(60 marks)
- b) Select two major processes of the hydrological cycle. For each process:
- a. Define the process and explain its significance in the water cycle.
 - b. Identify key factors that influence the process.
 - c. Describe at least one method used to measure or quantify it.

(40 marks)

Question 02**(Total -100 marks)**

A catchment area receives an average annual precipitation of 1300 mm. The annual evapotranspiration is estimated to be 550 mm, and the annual runoff is measured to be 420 mm. Additionally, 50 mm of water percolates into deep groundwater storage, which is considered a loss. The catchment drains into a reservoir with an initial water level of 12 meters. The reservoir also receives direct rainfall, and 50 mm of water is lost annually due to evaporation from the reservoir surface.

- a) Calculate the annual water inflow to the reservoir from the catchment area, considering all relevant losses.
(50 marks)
- b) If the catchment area is 180 square kilometers and the surface area of the reservoir is 2.5 square kilometers, estimate the net change in the reservoir water level over the year.
(30 marks)
- c) If 5 million cubic meters of water are released from the reservoir during the year for downstream use, determine the final water level in the reservoir at the end of the year.
(20 marks)

Question 03**(Total -100 marks)**

Data given in Table 1 were collected during a stream gauging operation in a river. A current meter with a calibration equation $V = (0.32N + 0.032)$ m/s where N = revolutions per second was used to measure the velocity at 0.6 depth. Using the mid-section method, calculate the discharge in the river.

Draw a neat sketch and mark the dimensions clearly. Indicate the calculation steps of important parameters.

Distance from right bank (m)	Depth (m)	Number of Revolutions	Observation Time (s)
0.0	0.0	0	0
2.0	0.5	80	180
4.0	1.10	83	120
6.0	1.95	131	120
9.0	2.25	139	120
12.0	1.85	121	120
15.0	1.75	114	120
18.0	1.65	109	120
20.0	1.50	92	120
22.0	1.25	85	120
23.0	0.75	70	150
24.0	0.0	0	0

Table 1: stream gauging details

Question 04**(Total -100 marks)**

Using the 4 hr unit hydrograph given in Table 2, derive the flood hydrograph due to the storm given in Table 3. The ϕ index for the storm can be assumed to be 0.15 cm/h. Assume the base flow to be 25 m³/s constant throughout.

Time (hr)	0	4	8	12	16	20	24	28	32	36	40	44	48
4hr UH ordinates(m ³ /s)	0	15	50	120	100	80	60	45	30	20	10	5	0

Table 2: 4 hr UH ordinates

Time from beginning of the storm (hr)	0	4	8	12
Accumulated rainfall (cm)	0	3.6	6.2	8.8

Table 3: storm details

Question 05**(Total -100 marks)**

A reservoir has the elevation, discharge and storage relationship given in Figure 1. When the reservoir level was at 100.5 m the flood hydrograph given in Table 4, entered the reservoir.

- i. Starting from the basic Equation, Derive the equation for Modified Pul's method. (25 marks)
- ii. Obtain the ordinates of the outflow and the reservoir elevation as a result of the passage of flood hydrograph across the reservoir. (Attach the given graph with your answers) (75 marks)

Time (hr)	0	6	12	18	24	30	36	42	48	54	60	66	72
inflow (m ³ /s)	10	20	55	80	73	58	46	36	27.5	20	15	13	11

Table 4: Flood Hydrograph

Question 06**(Total -100 marks)**

- i. A 25 cm diameter well fully penetrates a confined aquifer of permeability 45 m/day. Aquifer thickness is 30 m. After continuous pumping at a steady rate of 1800 lpm (liters per minute), the drawdowns in two observation wells, located 30 m and 90 m from the pumping well, were measured to be 3.8 m and 2.1 m, respectively.
 - a) Illustrate the well, observation wells, aquifer boundaries, and drawdowns in a clear diagram. (10 marks)
 - b) Starting from the Darcy's Law, derive the equation for the steady flow in the aquifer. (20 marks)
 - c) Determine the transmissivity of the confined aquifer (10 marks)
 - d) Estimate the drawdown at the pumping well. (20 marks)
- ii. Differentiate the following formations based on porosity and permeability:
 - Aquifer
 - Aquitard
 - Aquiclude
 - Aquifuge

(40 marks)

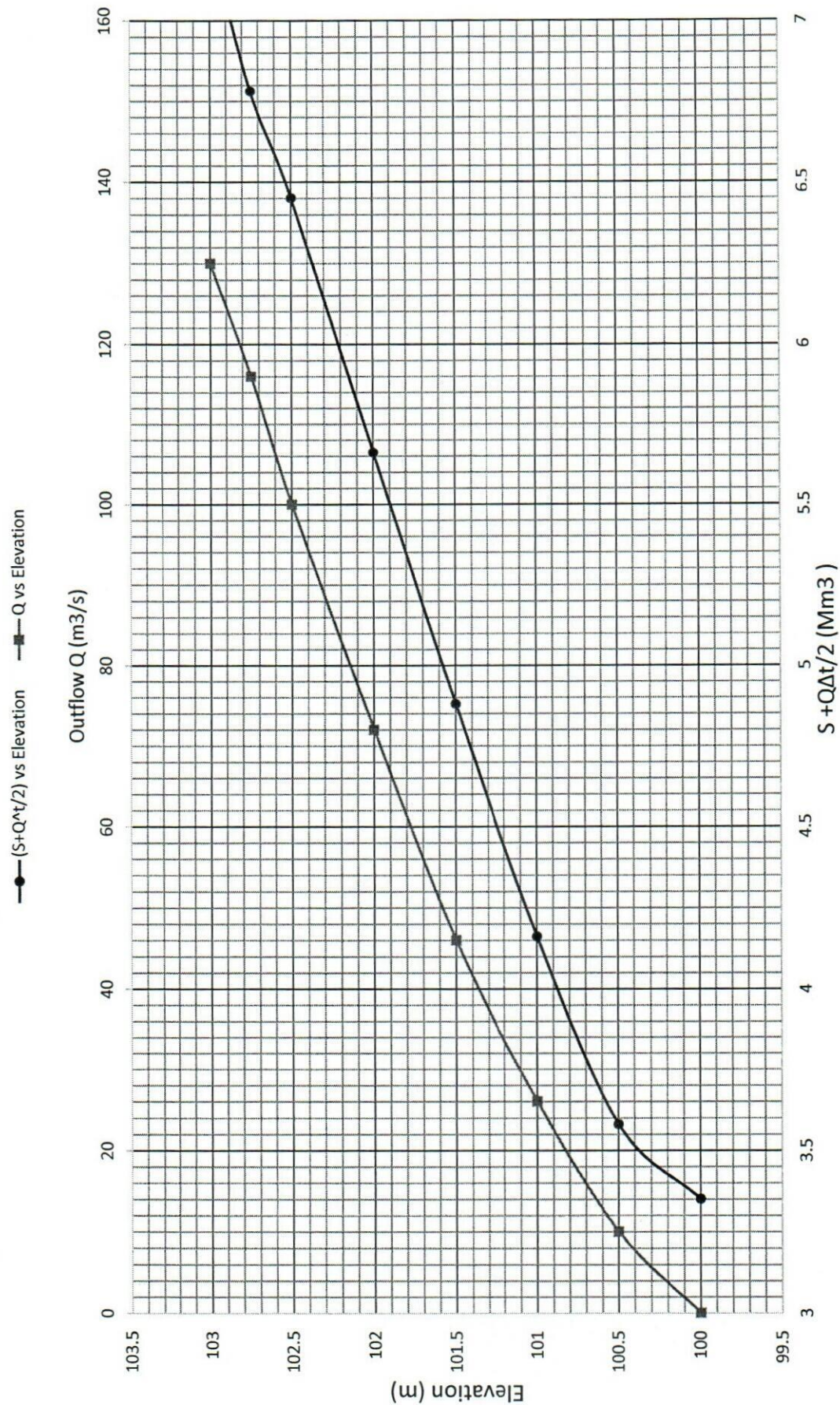


Figure 1

**Faculty of Engineering & Technology****Department of Civil Engineering****Bachelor of Science Honours in Engineering****Year 2 Semester 1 Final Examination 2025**

Module Code	:	CE2316
Module Title	:	Construction Materials
Date/Time	:	22 nd February 2025 / 01.30 pm – 04.30 pm
Examiner	:	P.W Gavithra Udayakumara
Time Allowed	:	Three hours only

INSTRUCTIONS TO CANDIDATES

- This is a **closed book** examination.
- This Paper consists of 5 questions. You should attempt all 5 questions.
- Show all stages of your work.
- This paper contains 04 pages.

MATERIALS REQUIRED

- Answer Booklet.
- You may use a scientific calculator. This must not be programmable and may be inspected during the examination.
- Extra answer papers (if required)

Student Number

Question 01

Bricks play a vital role in construction industry as a load bearing and non-load bearing material.

- a) Briefly explain the using of advantages and disadvantages of using bricks for construction projects (2 marks)
- b) Perform a comparison between conventional bricks and standard bricks based on 3 facts. (3 marks)
- c) Flemish bond pattern is proposed for load bearing walls.
 - I. Draw a neat sketch of load bearing walls by highlighting the specifications (2 marks)
 - II. Indicate 3 advantages and limitations of using Flemish bond pattern. (3 marks)
- d) If you have to check the quality of the bricks brought to the site, outline 2 methods that you are recommending with the aid of diagrams (4 marks)
- e) List 4 good workmanship practices need to be implemented to achieve an acceptable quality during the construction of wall (4 marks)
- f) Explain the difference between the “weather shield” and “Emulsion” paints applied on the walls (2 marks).

Question 02

Timber uses commonly as a construction material all over the world. It is important to ensure the effective usage of timber by implementing the latest technologies for manufacturing processes.

- a) Describe the process of manufacturing structural timber from the tree by indicating the main stages. (4 marks)
- b) What are the properties of timber which affect the strength of timber [4 marks]
- c) Do a brief comparison between “Air Seasoning” and “Kiln Seasoning” by mentioning at least 3 facts (5 marks)
- d) Explain how you would check whether the density of timber is satisfactory? You may use sketches if needed. [3 marks]
- e) What are the reasons for timber preservations? Briefly explain the methods of applying timber preservatives and where every method is used [4 marks]

Question 03

A cost-effective housing scheme is proposed in Gall city limits with single- and two-storied structures. Soil at the site found to be good laterite soil and ground water level is at considerably low level. Grade 30 concrete is going to use for the construction of the super-structure. Client is interested in bringing the cost down with good quality construction. How would your advice in relation to the quality control of following building elements?

- a) If you're the consultant of the project, briefly explain 3 factors that you consider when selecting the building material/s for the exterior framework (Zero marks will be given, if you just list three factors without explaining) [6 marks]
- b) If reinforced concrete is used in this project, what would be the possible deterioration that can be heightened due to the location/ environment of the building?
Suggest two measures to prevent or hinder this deterioration. [3 marks]
- c) Explain the benefits of using "water reducing admixtures" in concrete manufacturing process with practical examples [3 Marks]
- d) Define the meaning of "Grade 30" concrete? [2 Marks]
- e) What are the special properties of fly-ash that improve the cohesiveness of concrete mix and how it assists when concrete is pumped [4 Marks]
- f) Mention 3 types of sustainable materials that can be proposed to use as raw ingredients in concrete manufacturing process (2 marks)

Question 04

The bore hole reports of a proposed housing project shows that the soil at the site is mainly consists with sandy laterite which is relatively stable. Three storied houses have reinforced concrete frame work and brick infill walls where the two storied houses having load bearing brickwork. If you are the engineer in-charge of the project, explain the following with neat sketches as required

- a) Identify the main components of Portland cement and the way each component can contribute to the development of the strength. (5 marks)
- g) Briefly describe how these properties will affect the workability of fresh concrete.
 - ii) Water/Cement ratio content [3 Marks]
 - iii) Aggregate texture [2 Marks]
- b) Describe three different types of raft foundations with neat sketches indicating their applications (5 marks)
- c) What is meant by "Gap Grading"? (2 Marks)
- d) Name three test on bitumen before its application (3 Marks)

Question 05

Lots of materials such as steel, Bitumen and cement are using widely in the Civil engineering industry as raw materials for various construction purposes. Based on these materials, comment on below mentioned questions.

- a) Mention the raw materials use in iron making process and steel making process [3marks]
- b) Mention four filler materials that can be used in asphalt. And mentioned two functions of filler materials [3 marks]
- c) Explain the role of "Gypsum" in Portland cement (3 marks)
- d) Briefly Explain how the corrosion of reinforcement lead to deterioration of the properties of a concrete (4 marks)
- e) List 3 precautionary measurements that can be implemented to prevent the deterioration of Reinforcement of concrete (3 marks)
- f) Briefly explain the stiffening and setting of cement paste [4 marks]



Faculty of Engineering & Technology
Department of Civil Engineering
BSc Hons (Eng) Civil Engineering
Semester 5 First Sit - Final Examination 2025

Module Code	:	CE3316
Module Title	:	Construction Planning and Cost Estimation
Date	:	9 th February 2025
Examiners	:	Mr. Kushan Hirimuthugoda
Time Allowed	:	(09 00 am – 12.00 noon)- 3 hrs

Instructions to Candidates:

- This is an open book exam.
- This paper consists of two parts. Part **A** and Part **B**. Answer all questions from Part **A** and Part **B**.
- Use the Same booklet to answer Part **A**
- The suggested time period for Part **A** is **50 minutes** and Part **B** is **130 minutes**
- Use only the answers booklet, additional papers, and graph paper for your answers provided by the exam department.
- Write clearly and legibly with a blue or black pen.
- Write your name and student number on all sheets.
- Answers to different parts of the same question (other than any graph sheets used) should not be scattered.

Part A

1. Which of the following is NOT a direct cost in a construction project
 1. Material cost
 2. Labour cost
 3. Subcontractor cost
 4. Head office administration cost
 5. Equipment cost
2. Which of the following statements are correct about estimating activity durations
 - a. A delay in an activity in the critical path will always delay the entire project
 - b. A delay in an activity which is not in the critical path will never delay the project
 - c. The critical path method is used to calculate the minimum project duration
 1. a only
 2. a and b only
 3. a and c only
 4. b and c only
 5. All
3. What is a similar name for slack
 1. Float
 2. Buffer
 3. Lag
 4. Reserve
 5. Schedule
4. Which of the following is the most reliable method of allocating cost of an ongoing project
 1. % of work complete
 2. % of time complete
 3. Value of work complete
 4. % of advance payment paid
 5. Value of material and labour cost
5. Which of the following statements are correct about effects of Scale on Construction Cost
 - a. Increasing production all the time will give the advantage of economies of scale
 - b. If you pass the optimum design point, economies of scale can be led to diseconomies of scale
 - c. The cost of a construction project always varies linearly with respect to different facility sizes
 1. a only
 2. b only
 3. c only
 4. a and b only
 5. b and c only

6. When you are using MS project software to make Gantt chart what is the sequence that you use to complete it

- a. Define the project
- b. List the tasks in the project
- c. Define general working time
- d. Schedule tasks
- e. Organize task into phases

1. a → b → c → d → e
2. a → c → b → d → e
3. a → c → b → e → d
4. a → b → c → e → d
5. a → c → d → b → e

7. You are the newly appointed project engineer of a proposed construction of a precast bridge. In general, it can be completed in 15 weeks time. But when analyze the past projects adverse weather can stretch the project to 18 weeks. If the weather is good it can bring down the duration to 12 weeks. Using Three Point Estimating method what is the expected time duration of the project

1. 12 weeks
2. 14 weeks
3. 15 weeks
4. 16 weeks
5. 18 weeks

8. Which of the following statements are correct about 3D printing

- a. Components can be printed and then transported to the construction site, ready for immediate use
- b. The technology does not enable on-site printing of materials
- c. The initial cost of installing 3D printing machine is very high

1. a only
2. a and b only
3. a and c only
4. b and c only
5. All

9. Which of the following cost incurs at the project initiation phase of a project

1. Cost for tendering
2. Cost for feasibility studies
3. Construction sum
4. Snagging cost
5. Commissioning cost

10. Which one of the following is the main tool for creating WBS (Work Breakdown Structure) which breaks the work tasks further even into activities that can be estimated
1. Expert judgement
 2. Decomposition
 3. Delphi Technology
 4. Facilitation
 5. Rolling wave method
11. Which of the following statements are correct about price/cost indices
- a. It is the normalized average of cost related to the given class of goods
 - b. The cost indices vary with the geography and the time period
 - c. This can be used as a tool to measure the inflation
1. a only
 2. a and b only
 3. a and c only
 4. b and c only
 5. All
12. Which of the following typically gives information on what resources you can use for various activities and when they are available
1. Gantt Chart
 2. Resource Calendar
 3. Activity List
 4. Work Breakdown Structure (WBS)
 5. Schedule Baseline
13. You are the project manager of a proposed construction project and you are in the cost estimation stage. Now you are evaluating the bids sent by various contractors to choose the best bid to go with. This TOOL is called
1. Vendor bid analysis
 2. Data analysis
 3. Reserve analysis
 4. Expert Judgement
 5. Facilitation

14. Which of the following can be used to select the right Technology for construction works

- a. Trial and evaluation
- b. Evaluate success and scalability
- c. Conduct through research

- 1. a only
- 2. a and b only
- 3. a and c only
- 4. b and c only
- 5. All

15. In which cost management process all estimates are added up and baselined for future comparison with the actual expenditure

- 1. Cost estimation
- 2. Cost budgeting
- 3. Cost controlling
- 4. Cost calculating
- 5. Cost evaluation

16. You have recently constructed an office Complex and now you have two options. Option A is to rent the building for Rs. 400,000.00 per month and Option B is used the space for your company which will save you a rent of Rs. 388,000.00 per month. What is the Opportunity Cost per month for choosing Option B over Option A

- 1. Rs. 388,000.00
- 2. Rs. 400,000.00
- 3. Rs. 12,000.00
- 4. 1.2
- 5. Not enough data

17. Which of the following statements are correct about Schedule compression techniques

- a. Crashing the project always add cost to a project
- b. Crashing the schedule means adding resources and it always shorten the project duration
- c. Fast tracking adds risk to a project

- 1. a only
- 2. a and b only
- 3. a and c only
- 4. b and c only
- 5. All

18. You are the site engineer of a building construction project. As soon as you complete the Pilling works (Activity A) you start column construction works (Activity B). what is the relationship between Activity A and Activity B
1. Start to Start
 2. Start to Finish
 3. Finish to Start
 4. Finish to Finish
 5. Not enough data
19. Which of the following is NOT an advantage of construction cost management
1. Improve profitability and competitiveness
 2. Increase productivity
 3. Reduces the flexibility and process improvement in a company
 4. Deliver a quality product
 5. Foresee on cost variations
20. In cost estimation of a construction project you keep 5% - 10% of the construction cost for the unexpected costs that can occur during construction. This cost is called
1. Preliminary cost
 2. Contingency cost
 3. Cost for miscellaneous works
 4. Risk allocation cost
 5. Provisional cost
21. Planned budget is a snapshot of.....
1. Life Cycle Costing
 2. Internal Rate of Return (IRR)
 3. Cost Baseline
 4. Cost aggregation
 5. Benefit Cost Ratio (BCR)
22. In your cost management process, you take activity estimate and roll them up in to control accounts of your Work Breakdown Structure (WBS). This process is called
1. Life Cycle Costing
 2. Internal Rate of Return (IRR)
 3. Cost Baseline
 4. Cost aggregation
 5. Benefit Cost Ratio (BCR)

23. Which of the following statements are correct about cost estimations

- a. Engineering estimate can be used to evaluate the bids sent by contractors
- b. Preliminary estimate and Engineering estimate are made at the cost estimation process of cost management
- c. The unit cost for each element in the bill of quantities must be assessed in order to compute the total construction cost

- 1. a only
- 2. a and b only
- 3. a and c only
- 4. b and c only
- 5. All

24. Which of the following is NOT an advantage of using computer aided cost estimation

- 1. Very common in use
- 2. Enhanced Accuracy
- 3. Time Efficiency
- 4. Enhanced Cooperation
- 5. Flexibility and Scalability

25. What is the standard that you commonly use for Method of Measurement of Building Works in Sri Lanka

- 1. BS 8110
- 2. SLS 573
- 3. EN 1990
- 4. SLS 233
- 5. SLS 517

(1X25 = 25 Marks)

Part B

1. Develop a Logic Network (Network Diagram) for the sequence of activities listed in the table. Calculate
- Early Start (ES)
 - Early Finish (EF)
 - Late Start (LS)
 - Late Finish (LF) time for all activities
 - Find the project duration and the Critical Path

Table Q.1

Activity	Duration(Weeks)	Predecessor
Start	0	None
A	3	Start
B	2	A
C	2	B
D	4	Start
E	1	D
F	5	Start
G	7	F
H	3	B, E
I	4	C, G, H
Finish	0	I

2. You are a newly appointed site engineer for construction of a two story house with a roof slab. You have been asked to identify the resource requirement for the work. For that you need to do the following
- Write down a detail WBS (Work Breakdown Structure) for the main parts of the construction works
 - Identify at least **five** resources that you need to complete those work activities
3. You are a newly appointed site engineer of a housing construction project. By the time when you are going to site almost all the structural works were completed. You need to **calculate the Total Construction Cost** of the water tank slab which is in the 3rd floor. You are asked to use **Grade 25** concrete for the slab and you can assume that reinforcement weight as 120kg per m³. Following details are given to you
- Note: - You need to clearly mention the assumptions that you use
 - All dimensions given are in mm (millimeters)

Table Q 3.1

Description	Material Rate (Rs)	Labour Rate (Rs)
Form work	1,700.00 per m ²	800.00 per m ²
Reinforcement	350.00 per kg	100.00 per kg
Concrete		
Cement	1,850.00 per bag	2,500.00 per m ³
Sand	24,000.00 per Cube	
Metal	16,000.00 per Cube	

Table Q3.2

Description of Machinery	Rate (Rs)
Concrete Mixture	5,000.00 per day
Poker Vibrator	1,000.00 per day
Hoist machine	7 500.00 per day
Other Machines	2,500.00 per day for 7 days

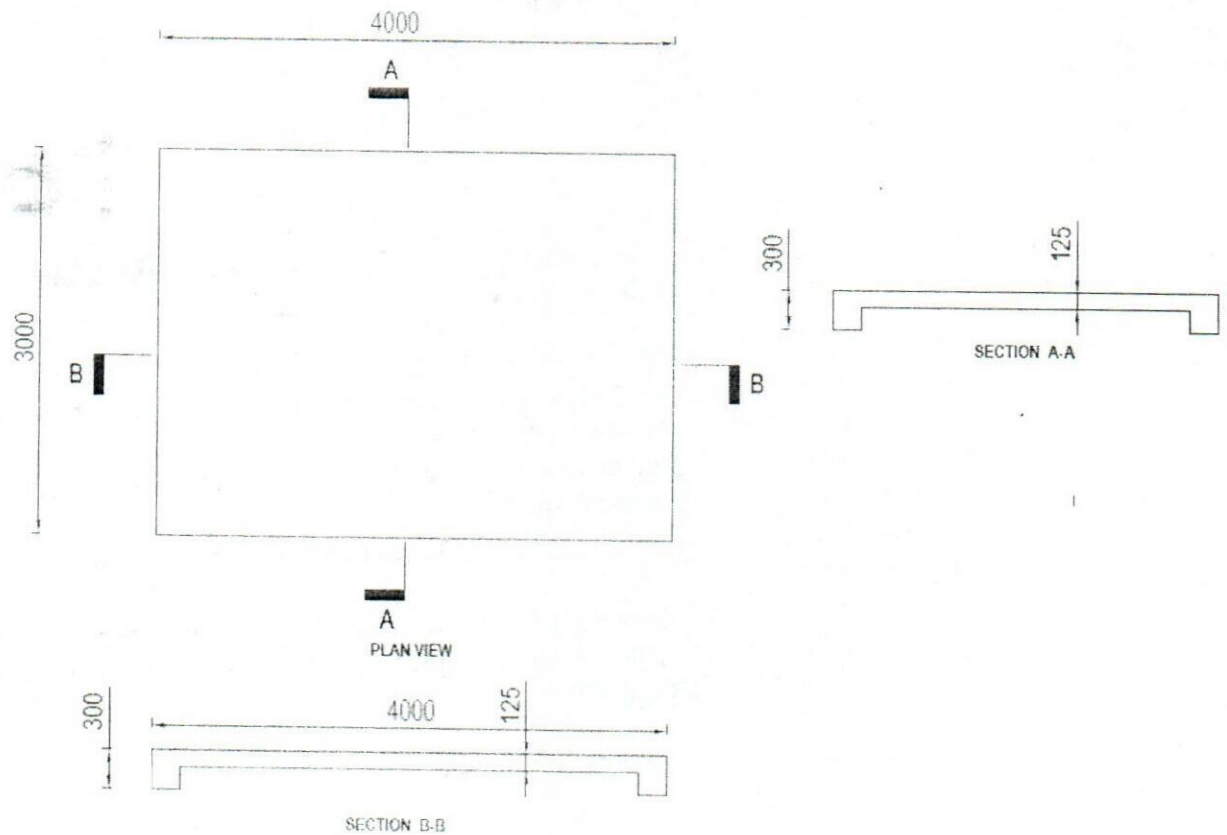


Figure Q3

- 4.
- Write **Three New Trends** use in construction industry in the world and describe **Two** advantages of using it and **one** disadvantage for each of the new trend
 - Describe **Three** advantages of having a **Cost Management Process** for a construction company with **examples**
5. The standard costs for the major equipment types for two ready-mix concrete plants with different daily production capacities are given in the following table.

Table Q5

Cost Data for Equipment and Ancillary Items				
Equipment Type	Equipment Cost (Rs.1000)		Cost of ancillary items as % of Equipment cost (Rs.1000)	
	50 m ³	200 m ³	50 m ³	200 m ³
Cement Silos and Aggregate Hoppers	3,000	8,000	30%	20%
Control System with room	5,000	10,000	60%	50%
Mixture and Conveyors	2,000	5,000	40%	30%
Other etc..	1,000	4,000	50%	40%

A new ready-mix concrete plant with a daily production capacity of 100 m³ is to be constructed in Hambantota in **three years**. **Determine The Total Preliminary Cost Estimate** of the machinery installation of the plant on the following basis;

- You can use linear interpolation from the Table given, and adjusted for inflation for the intervening three years. We expect inflation in the three years to be similar for all three years with a rate of 6%
- The location index for equipment installation is 1.15 for Hambantota, in comparison with the standard cost.
- An additional cost of Rs.1,000,000.00 was required for the local conditions in Hambantota
- The contingency cost due to inclement weather delay will be reduced by the amount of 2% of total construction cost of the given standards because of the favorable climate in Hambantota

(15x5 = 75 Marks)

-End of Questions-



Faculty of Engineering & Technology
Department of Civil Engineering
BSc Hons (Eng) Civil Engineering
Semester 5 First Sit - Final Examination 2025

Module Code	:	CE3312
Module Title	:	Soil Mechanics and Engineering Geology II
Date	:	15 th January 2025
Examiners	:	Supun Walpita / Iromi Diyes
Time Allowed	:	(09 00 am - 11.30 am)- 2 ½ hrs

Instructions to Candidates:

- This paper consists of Four (04) questions. Answer **all four** questions.
- Use only the answers booklet, additional papers and graph paper for your answers.
- Write clearly and legibly with a blue or black pen.
- Write your name and student number on all sheets.
- Answers to different parts of the same question (other than any graph sheets used) should not be scattered.
- Marks will be deducted for missing or incorrect measuring units.
- You are advised to make a clear diagram for each question, where appropriate. This will help you to perform calculations correctly.
- If You have any doubt regarding the interpretation of the wording of a question, make your own assumptions and clearly state it on the answer script.

- 1) **Figure 1** given below shows a flow net drawn for a sheet pile wall on an isotropic sandy soil with a permeability of 5×10^{-5} m/s

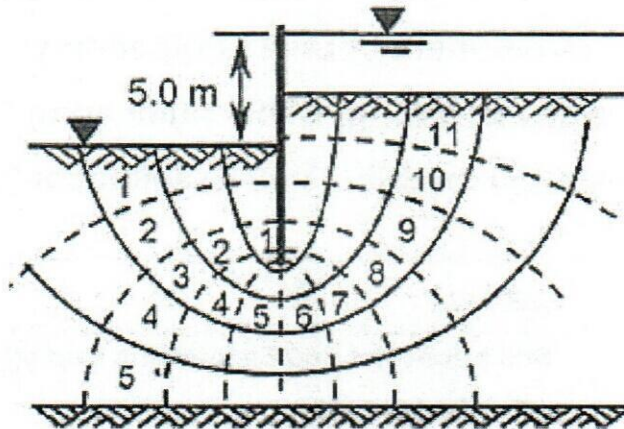


Figure 1

- a) Describe what boundary conditions are required to construct a flow net and show them in a sketch using the scenario given above **(4 marks)**
 - b) Determine the seepage loss per day per meter length of the pile wall **(6 marks)**
 - c) If the saturated unit weight of soil is 18 kN/m^3 and unit weight of water is 10 kN/m^3 , find the factor of safety against piping. **(6 marks)**
 - d) Suggest two measures that can be implemented to improve the factor of safety against piping **(4 marks)**
- 2)
- a) The soil profile in **Figure 2** consists of clay and sand with same saturated unit weights of 20 kN/m^3 . The water table is at ground level. A significantly wide embankment 4 m high is constructed from a fill with a unit weight of 15 kN/m^3 . Determine the total and effective vertical stresses at the center of the clay and at the center of the sand,
 - I. Before the embankment is constructed, **(6 marks)**
 - II. Immediately after the embankment is constructed. **(8 marks)**

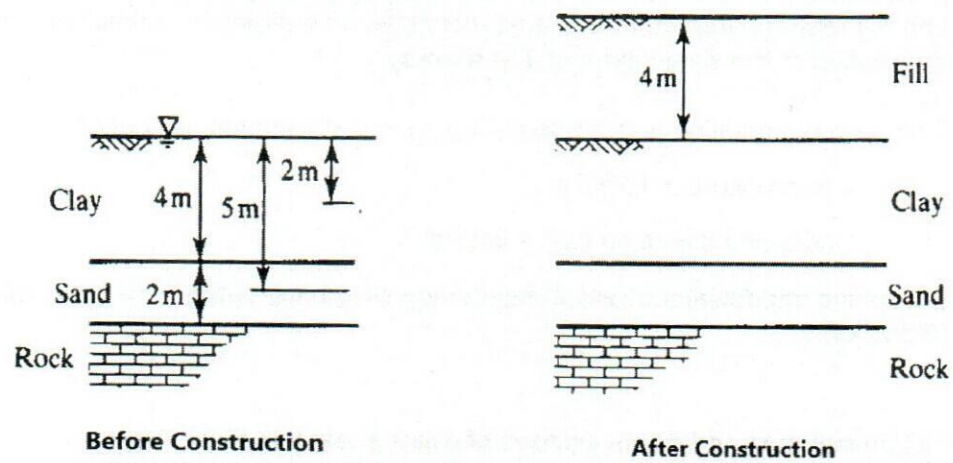


Figure 2

- b) An L-shaped foundation exerts a uniform pressure of 300kPa on a soil as shown in **Figure 3**. Find the vertical stress increments at points A & B at a depth of 2m below the foundation (12 marks)

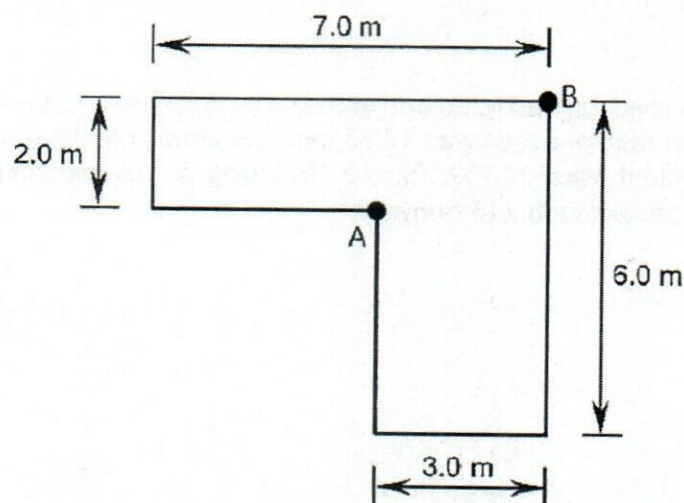


Figure 3

3)

- a) Describe consolidated drained test by giving attention to drain conditions at different phases and its effect on stress conditions developed during the test and the type of shear strength parameters obtained. Also give an example for stimulating field application of this particular test. **(10 marks)**

- b) Following observation was made during an unconsolidated undrained triaxial test

Cell pressure = 100kPa

Undrained cohesion (C_u) = 94kPa

Determine the deviator stress at failure and sketch the results in a mohr's circle diagram **(6 marks)**

- c) List advantages and disadvantages of direct shear test **(5 marks)**
d) Following observations were made during a direct shear test conducted on a purely frictional (cohesion less) soil

Shear stress at failure = 3.5kPa

Normal stress at failure = 10kPa

- I. Determine the friction angle (ϕ) **(5 marks)**
- II. Determine Major principal stress (σ_1) and minor principal stress (σ_3) **(8 marks)**

4)

- a) **Table 1** shows readings recorded during a consolidation test. At the end of the last stage, the thickness of the specimen was 17.53 mm, the stress had been raised by 100 kN/m². The water content was 24.7%. ($G_s = 2.70$). Using a suitable method, determine the coefficient of consolidation. **(15 marks)**

Table 1

Time (min)	Change in thickness (mm)
0	0
0.04	0.121
0.25	0.233
0.50	0.302
1.00	0.390
2.25	0.551
4.00	0.706
6.25	0.859
9.00	0.970
12.25	1.065
16.00	1.127
25.00	1.205
36	1.251
64.00	1.300
100	1.327
360	1.401
1440	1.482

- b) A surface load of 60 kPa is applied on the ground surface over a large area. The soil profile consists of a sand layer 2 m thick, the top of which is the ground surface, overlying a 4 m thick layer of clay. An impermeable boundary is located at the base of the clay layer. The water table is 1 m below the ground surface. If the preconsolidation pressure for a sample of soil from the mid-point of the clay layer is 60 kPa, calculate the consolidation settlement of the clay layer. The properties of the soil section are:

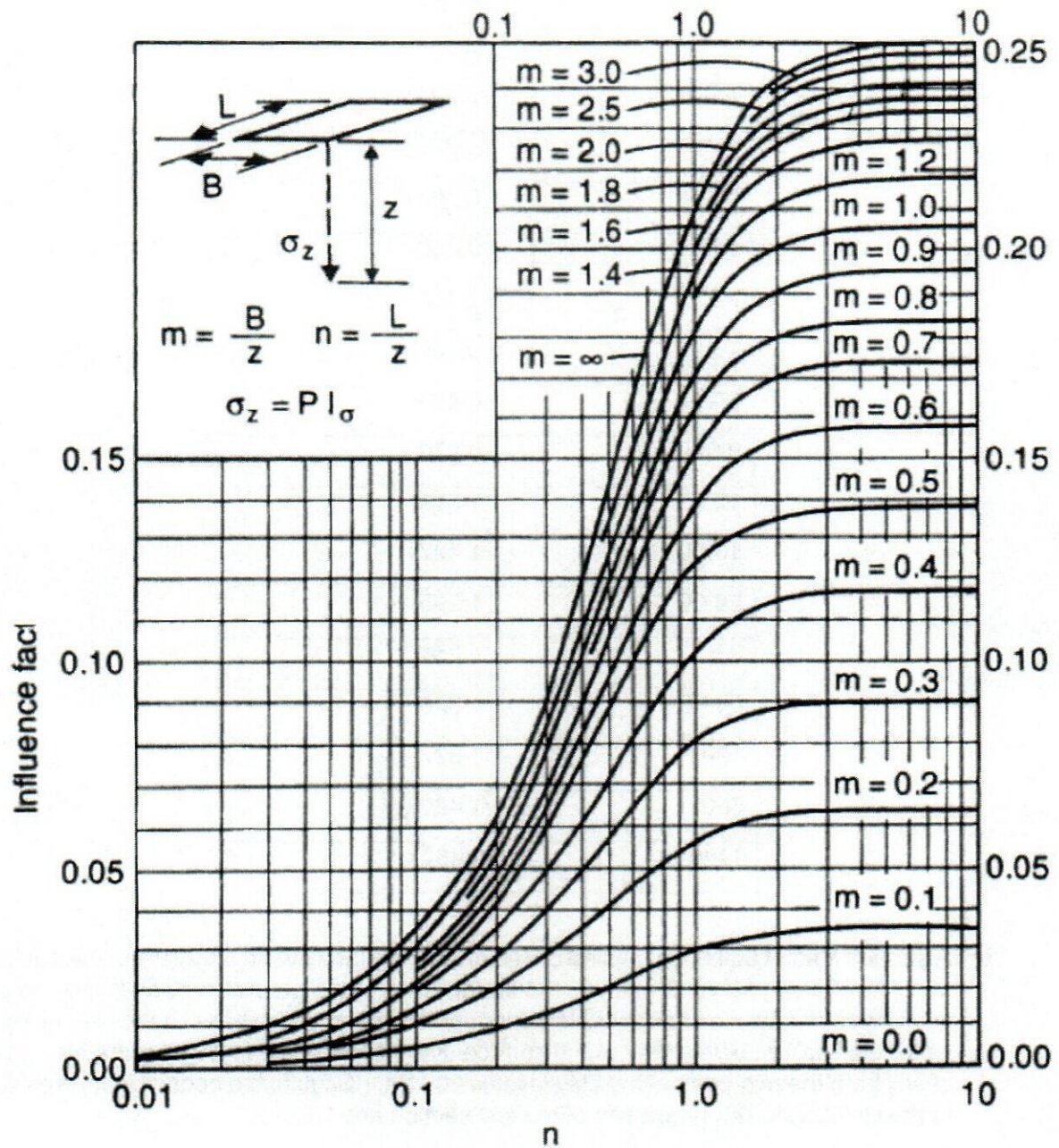
sand: $\rho_{\text{dry}} = 1.6 \text{ Mg/m}^3$, $\rho_{\text{sat}} = 1.9 \text{ Mg/m}^3$,

Clay : $\rho_{\text{sat}} = 1.65 \text{ Mg/m}^3$, $e_0 = 1.5$, $C_c = 0.6$, $e_f = 1.479$

(5 marks)

- End of Questions -

Additional Data



$$(q) = kh \frac{N_f}{N_d}$$

$$S_c = \frac{C_c}{1 + e_o} \log \left(\frac{\sigma'_1}{\sigma'_o} \right) H_o$$