



PAST PAPERS

Faculty	Department / Section/Division
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Past Papers

Faculty of Engineering and technology

**BSc. (Hons) in engineering in civil
engineering**

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Faculty of Engineering & Technology
BSc (Hons) in Engineering in Civil Engineering

CE4414 Structural Design III

Module Leader: Dr. Pasindu Weerasinghe

Academic Year 2024

Total time allocated 3 hours

INSTRUCTIONS TO CANDIDATES

This paper contains 2 questions on 6 pages.

Answer all the questions

This is an open book and open notes examination. Candidates are permitted to refer hard copies of Eurocode, National Annexes, lecture notes, and any other handwritten notes during the examination.

The total maximum mark obtainable is 100. The marks assigned for each question and parts thereof are indicated in each question.

If you have any doubt as to the interpretation of the wordings of a question, make your own decision, but clearly state it on the answer script.

Assume reasonable values for any data not given in or provided with the question paper, clearly state such assumptions made in the answer script.

You may use sketches in providing answers for the descriptive questions.

Question 01**(50 Marks)**

A client has purchased a 15 perch land in Athurugiriya area and he/she wants to construct a 2 storey house on that land. The architect has proposed the following layout (see Figure Q1.a and Q1.b) for the ground floor and first floor. You are hired as the structural design engineer to design the house. Load-bearing masonry construction was identified as suitable for the building. Accordingly, the load-bearing walls identified are highlighted in black colour.

The architect proposes a ZN-AL roof, which is supported by the perimeter walls only. Considering the thermal comfort and to reduce the plastering cost, the architect proposes a novel clay brick with a smooth finish that does not require plastering or painting. Walls can be constructed using general purpose mortar having a nominal thickness.

The clay brick's properties and other relevant information are presented below.

- Dimensions of the brick – 400mm x 200mm x 100mm (length x width x height)
- Wall thickness – 200 mm
- Random rubble foundations are used for load-bearing walls and the walls are firmly connected to the foundation.
- Compressive strength of brick – 8 N/mm²
- Water absorption of bricks – 8 %
- Flexural strength values (found from a laboratory test) – 0.6 N/mm² and 1.0 N/mm²
- Manufacturing control – Mean compressive strength complies with EN 771
- Volume of all (vertical) holes in the brick is 10 % of the gross volume.
- Thickness of the RC floor slab – 150 mm
- Density of reinforced concrete – 25 kN/m³
- Density of clay brickwork – 22 kN/m³
- Elastic modulus of concrete – 25 kN/mm²
- Elastic modulus of brick masonry – 1 kN/mm²
- Height of ground floor walls and first floor walls – 3.8 m
- Finishes on slab – 0.80 kN/m²
- Characteristic imposed load on floor slabs – 1.25 kN/m²

You may assume any other parameters that are not given, but clearly state your assumptions. You are expected to carry out the design according to Eurocode 6.

- a. How would you justify the selection of load bearing masonry for this construction?
[2 marks]
- b. Determine all the characteristic dead and imposed loads transferred to the ground floor wall AB. Hence, indicate the design loads at top, mid-height and bottom of the wall on a clear sketch. For this calculation, you may assume there are no openings on the ground floor for this calculation.
[5 marks]
Hint: You may consider the highlighted slab part adjacent to wall AB on the first floor to be one-way spanning.
- c. Does the slenderness ratio of the ground floor wall AB satisfy EC6 requirement? Justify using a calculation.
[2 marks]
- d. Total out-of-balance moment transferred to the wall AB at the first floor level was found

- to be 1 kNm/m. Determine the moments at mid-height and bottom of the wall. [3 marks]
- e. Determine the eccentricities at top, mid height and bottom of the wall. [3 marks]
- f. Check whether the proposed new brick with M4 mortar has adequate strength for this load bearing wall (Wall AB). [10 marks]

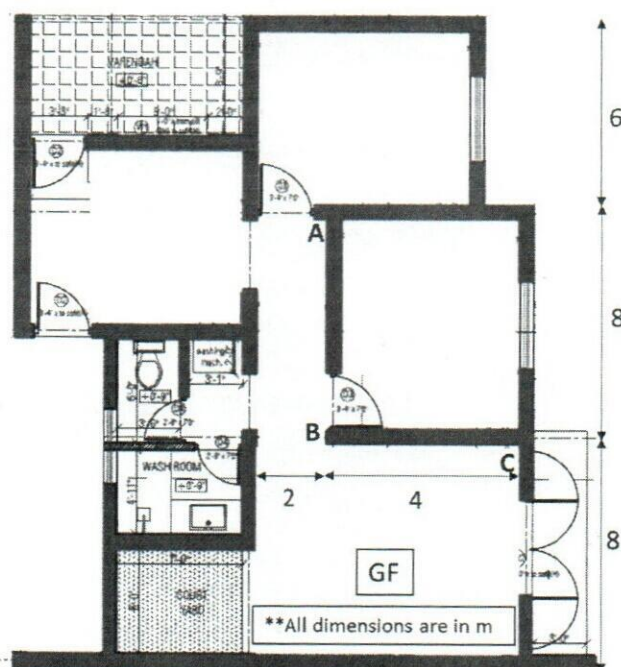


Figure Q1.a

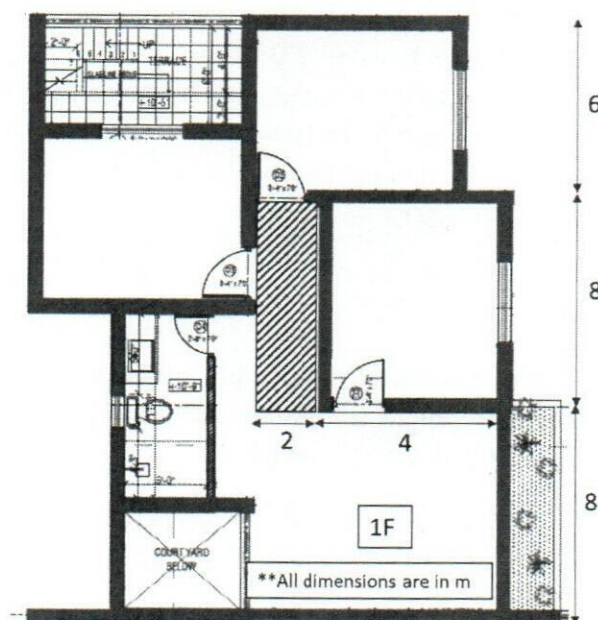


Figure Q1.b

- g. An opening for a door will be provided on the ground floor section of wall AB and Figure Q1.c shows the elevation of the wall with the opening. A lintel beam of 200 mm $\times$ 300 mm will be provided with a bearing length of 300 mm on one side (P). Check whether that bearing length is adequate or not. You may assume that the load on the other side (Q) will be taken by wall BC. Check only the crushing failure under the concentrated load. Consider the same bricks and mortar designation as in part f).

Hint: You can consider the same loads that you have calculated in part b) to be acting at the top of the wall. [10 marks]

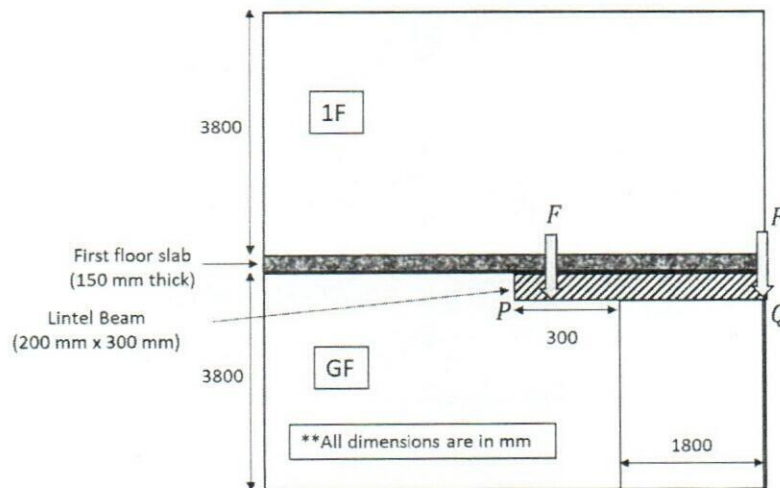


Figure Q1.c

- h. The client wishes to have a 1.4 m high boundary wall along the perimeter of the land. You are asked to design that boundary wall and preliminary calculations indicate a characteristic wind load of 1 kN/m² acting on the wall. Check whether a single brick thick wall (200 mm) would suffice. You may design it as a free-standing cracked wall section. Assume the same bricks are available for the boundary wall as well. [9 marks]
- i. Prior to the construction of the wall, it was seen that the bricks were being soaked in water. What could be the reason for that? Briefly explain the relevance of that to the overall performance of the wall. [3 marks]
- j. "Masonry column design is similar to vertically loaded masonry wall design. However, the limiting slenderness ratio for columns is less than that for the walls". Do you agree with this statement? Give reasons for your answer. [3 marks]

Question 02**(50 marks)**

You are assigned as a member of the structural design engineering team for a new building complex for a university. It is proposed to construct an elevated timber deck for the canteen. It consists of 30 mm thick 300 mm wide timber floor planks that will be supported on timber beams. The timber beams will rest on wall plates that will be supported on short masonry walls. Figure Q2.a shows a timber floor beam that supports the floor boards. The distance between the supports is 5.0 m and the overhang is 1.0 m. The beams are to be spaced at a distance of 1.0 m. The proposed dimensions of the timber beam are 100 mm x 200 mm and it is intended to use D70 timber.

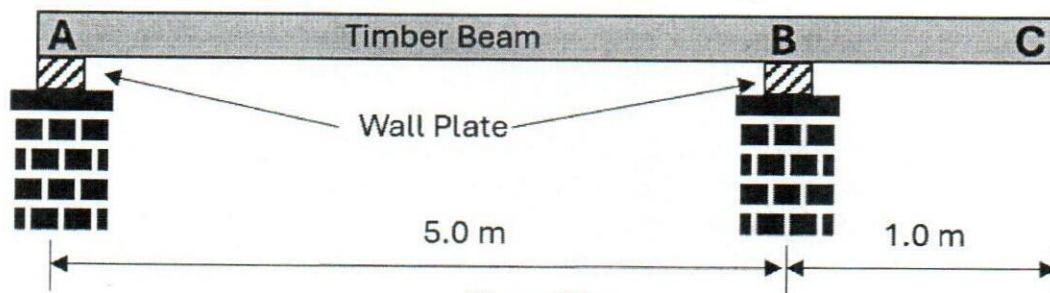
The floor beam has been analyzed and the results are given below.

At Ultimate Limit State

- Design bending stress in the timber beam - 22 N/mm^2
- Design shear stress in the timber beam - 1.5 N/mm^2
- Design bearing action in the beam at support B - 8 kN

At Serviceability Limit State

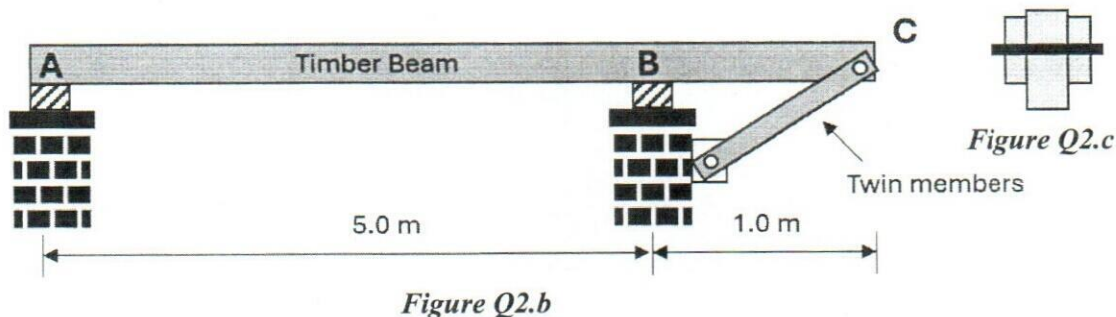
- Maximum instantaneous deflection in the floor beam - 12 mm



- Check whether the proposed dimensions of the timber floor boards (planks) are suitable considering the limit state of deflection, if the instantaneous deflection of timber plank is 1.8 mm under serviceability conditions. [4 marks]
- Check whether the floor beam is safe in bending under long term service class 3 conditions. [5 marks]
- Briefly explain whether there is a danger of lateral buckling and twisting of the floor beam and where this would occur, if it is assumed that the floor boards provide lateral support to the floor beam. No calculations are required. [5 marks]
- Check whether the floor beam is safe in shear under long term service class 3 conditions. [4 marks]

- e. Determine the minimum width required of the wall plate at support B considering the bearing failure. [6 marks]

In order to increase the load carrying capacity of the floor beams it is proposed to modify the timber structure as shown in Figure Q2.b. Two side members of each 25 mm thickness and 100 mm wide of D60 timber are connected at the free end of the overhanging portion as shown in Figure Q2.c. The members are inclined at 30° to horizontal. They are connected at each end with single M12 bolts.



- f. Determine the embedment strength of;
- i. the timber of the twin members in the parallel to grain direction. [4 marks]
 - ii. the floor beam in the direction of the twin members. [6 marks]
- g. Determine the characteristic lateral load resistance $F_{v,k}$ of the bolted joint for a single shear plane, considering only modes of failure g) and h). The characteristic lateral load resistance $F_{v,k}$ corresponding to modes j) and k) failure are 16,270 N and 18,000 N respectively for a single shear plane of the bolted joint. [7 marks]
- h. Provide a sketch that identifies the expected mode of failure. [4 marks]
- i. Determine the design lateral load resistance $F_{v,d}$ of the bolted joint under long term service class 3 conditions. [5 marks]

End of question paper

Faculty of Engineering & Technology



Bachelor of Science Honours in Engineering in Civil Engineering

CE4322 Environmental Engineering

Resit Examination

Module Leader: Ms. Luckshi Ranasinghe

Academic Year: 2024

Date: 23rd August 2024

Time: 0900 – 1200 hours

Instructions to Candidates:

- This paper contains five (05) questions on nine (09) pages. Answer **all five** questions.
- All questions carry equal marks.
- 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.
- Assume reasonable values for any data/information not provided with the exam paper (clearly state the assumptions).
- This is a **close-book exam**, you are not allowed to bring in your study notes. The use of a non-programmable calculator is allowed.
- The nomograph given should be attached to your answer script.

Question 1

Water pollution can be categorized as surface water pollution and groundwater pollution. Groundwater is usually of excellent quality due to natural filtration in the soil layers.

- a) A well-mixed 25mL of raw wastewater is used for Total Solids (TS) analysis and a 50mL for Suspended Solids (SS) analysis. The weight of the evaporating dish was obtained according to the standard method.

Weight of evaporating dish	= 32.3612g
Weight of dish + residue after evaporation at 105°C	= 32.3875g
Weight of dish + residue after ignition at 550°C	= 32.3752g
Weight of filter + crucible	= 11.5308g
Weight of residue + filter + crucible after drying at 105°C	= 11.5447g
Weight of residue + filter + crucible after ignition at 550°C	= 11.5349g

Compute the concentration of total solids, volatile solids, fixed solids, total suspended solids, volatile suspended solids, and fixed suspended solids.

[7 marks]

- b) Briefly explain the nutrient cycle of a reservoir by listing the four stages of eutrophication.

[4 marks]

- c) Discuss the self-purification process in a river/stream by listing three contributing factors.

[3 marks]

- d) In a stream the Biological Oxygen Demand (BOD) is 5mg/L, Dissolved Oxygen (DO) is 8mg/L, and the flow rate is 20m³/d. A treated wastewater effluent with BOD of 80 mg/l is discharged into the stream at a rate of 5 m³/d. The DO of the wastewater effluent is 6 mg/l. Assuming that K₁ is 0.2, K₂ is 0.5 and the saturation DO is 10mg/l, determine the minimum DO level and estimate the distance at which the minimum DO occurs from the point of waste discharge if the stream flow velocity is 0.1 m/s.

$$t_c = \frac{1}{k_2 - k_1} * \log \left[\frac{k_2}{k_1} * \left\{ 1 - \frac{D_i(k_2 - k_1)}{k_1 * BOD_L} \right\} \right]$$

$$D_c = \frac{(k_1 * BOD_L)}{(k_2 - k_1)} * (10^{-k_1 t_c} - 10^{-k_2 t_c}) + [D_i * 10^{-k_2 t_c}]$$

[6 marks]

Question 2

A water supply scheme is designed for a proposed industrial zone and housing scheme with a population of 20,000 people, with an average consumption of 150 Liters per person per day. The industrial zone has 50 small-scale industries, each requiring 10,000 Liters per day.

The water supply scheme must meet the demands of both the industrial zone and the housing scheme. Half of the industrial demand can be met by a deep well and the remaining water demand of the scheme is met through river intake.

- a) List 3 factors that should be considered when designing this water supply system.

[3 marks]

- b) Calculate the proposed design's daily water demand, including the industrial zone and housing scheme.

[4 marks]

- c) A transmission main line is to be constructed with a velocity of 0.5 m/s. Use the Hazen Williams nomograph by considering C to be 100 for the pipe material.

- i. Calculate the transmission main diameter for the water demand.
- ii. What is the head loss for the selected pipe diameter if the main is 1500 m long?

(Use the Hazen-Williams formula nomograph provided and attach it to the answer script. State any assumptions made.)

[5 marks]

- d) To ensure safe water supply for the scheme describe the stages of water treatment required, taking into consideration that both deep well and surface water are extracted to fulfill the demand.

[4 marks]

- e) It is suggested to use chlorine as a disinfectant to purify the water before distribution. List out the advantages and disadvantages of this disinfection method.

[4 marks]

Question 03

The establishment of the proposed commercial zone in the Kurunegala District could have potential impacts on the surrounding environment, particularly on the near-surface and groundwater bodies due to the industrial effluents discharged. This could have detrimental effects on surrounding ecosystems and potentially harm organisms that rely on these water bodies. Hence, a wastewater treatment plant is constructed to treat the effluents before disposing to the environment.

- a) Design the coarse screen by estimating the number of bars, openings, and their widths. Calculate the head loss of a bar screen for the below-mentioned characteristics. Assume necessary design criteria.

Peak flow rate = 0.80 m³/s

Upstream water depth = 1.50 m

Velocity through the screen at maximum wet weather flow = 0.80 m/s

Inclination = 60° to horizontal

Channel width = 1.25 m

[6 marks]

- b) Effluent polishing is a tertiary process in wastewater treatment. Briefly explain the principle of effluent polishing and its objective.

[4 marks]

- c) Explain in detail the two main objectives of the biological treatment of wastewater.

[4 marks]

- d) The activated sludge process in the water treatment plant is to be designed. Compute the mean cell residence time and recirculation ratio of the reactor from the following data to design a conventional activated sludge process.

Daily wastewater flow = 20 MLD

Sludge wasting flow = 140 m³/d

Biomass concentration in reactor = 4000 mg/l

Hydraulic retention time	= 4 hrs
Returned sludge concentration	= 10,000 mg/l
Influent substrate concentration	= 200 mg/l
Effluent substrate concentration	= 30 mg/l

$$\theta_c = \frac{VX}{Q_w X_r + Q_e X_e}$$

$$V = Q_o \theta$$

$$R = \frac{Q_o(X - X_e) - Q_w(X_r - X_e)}{Q_o(X_r - X)}$$

[6 marks]

Question 04

The southern region of Sri Lanka is facing significant coastal erosion. It was proposed that a seawall, a concrete structure built parallel to the shore at the transition between the beach and the mainland, be constructed to protect the inland area against wave action and prevent erosion.

Due to the high sensitivity of the surrounding environment, the Coast Conservation and Coastal Resources Management Department requested an Environmental Impact Assessment (EIA), which is tasked with analysing the structure's potential environmental consequences, evaluating the impact's significance, and proposing effective strategies to mitigate any adverse effects.

Upon submission, the EIA will undergo an adequacy check to confirm that it fulfills the Terms of Reference (ToR) stipulated by the Project Approving Agency (PAA). Following this verification, the report will be available for public inspection and comments for 30 days to ensure adherence to regulatory standards and incorporate stakeholder feedback. The PAA then conducts regular monitoring to ensure that it adheres to the recommendations and mitigation methods stipulated.

- a) Design a TOR for the proposed construction project by assuming the role of the Coast Conservation and Coastal Resources Management Department of Sri Lanka.

[2 marks]

- b) Analyse how the seawall's construction could potentially affect sediment transport and aquatic animals in the ocean.

[5 marks]

- c) Propose mitigation strategies to minimize the negative environmental impacts of the construction, focusing on sustainable practices that can be implemented.

[5 marks]

- d) Discuss the importance of involving local communities in the EIA process and how their input can lead to better project outcomes.

[4 marks]

- e) Identify and explain the challenges of incorporating public feedback into environmental decision-making for large infrastructure projects.

[4 marks]

Question 05

The increasing urbanization in Colombo has led to the requirement of a new waste management strategy to handle the city's solid waste. Improper handling of the different waste types generated in the area may be detrimental to the environment and cause irreversible damage.

- a) Define the importance of solid waste management in urban areas.
[4 marks]
- b) Discuss the key components of an effective solid waste management system.
[4 marks]
- c) If the city generates 500 tons of waste per day and the landfill has a compacted density of 0.7 tons/m³, calculate the landfill area required to dispose of a year's waste. Assume a landfill height of 10m.
[2 marks]
- d) Explain the role of recycling in reducing the burden on landfills and describe three methods for promoting recycling in urban areas.
[4 marks]
- e) Discuss the environmental and social challenges associated with landfill operations and propose strategies to address these challenges.
[4 marks]
- f) After conducting the waste stream analysis, the following data was observed. Calculate the moisture content and density of the sample using Tables 1 and 2.

Component	Percent by mass
Food waste	15
Paper	45
Cardboard	5
Plastic	35

[2 marks]

Component	Moisture, percent	
	Range	Typical
Food wastes	50-80	70
Paper	4-10	6
Cardboard	4-8	5
Plastics	1-4	2
Textiles	6-15	10
Rubber	1-4	2
Leather	8-12	10
Garden trimmings	30-80	60
Wood	15-40	20
Misc., organic	10-60	25
Glass	1-4	2
Tin cans	2-4	3
Nonferrous	2-4	2
Ferrous metals	2-6	3
Dirts, ashes, brick, etc.	6-12	8
Municipal solid wastes	15-40	20

Table 1: Moisture percent of solid waste components and mixtures.

Item	Density (kg/m ³)	
	Range	Typical
Component*		
Food wastes	120-480	290
Paper	30-130	85
Cardboard	30-80	50
Plastics	30-130	65
Textiles	30-100	65
Rubber	90-200	130
Leather	90-260	160
Garden trimmings	60-225	105
Wood	120-320	240
Misc., organics	90-360	240
Glass	160-480	195
Tin cans	45-160	90
Nonferrous metals	60-240	160
Ferrous metals	120-1200	320
Dirt, Ashes, Brick, etc.	320-960	480
Municipal solid wastes		
uncompacted	90-180	130
Compacted (in compactor truck)	180-450	300
In landfill (compacted normally)	350-550	475
In landfill (well-compacted)	600-750	600

* Data for components is on an as-discarded basis

Table 2: Typical densities of solid waste components and mixtures.

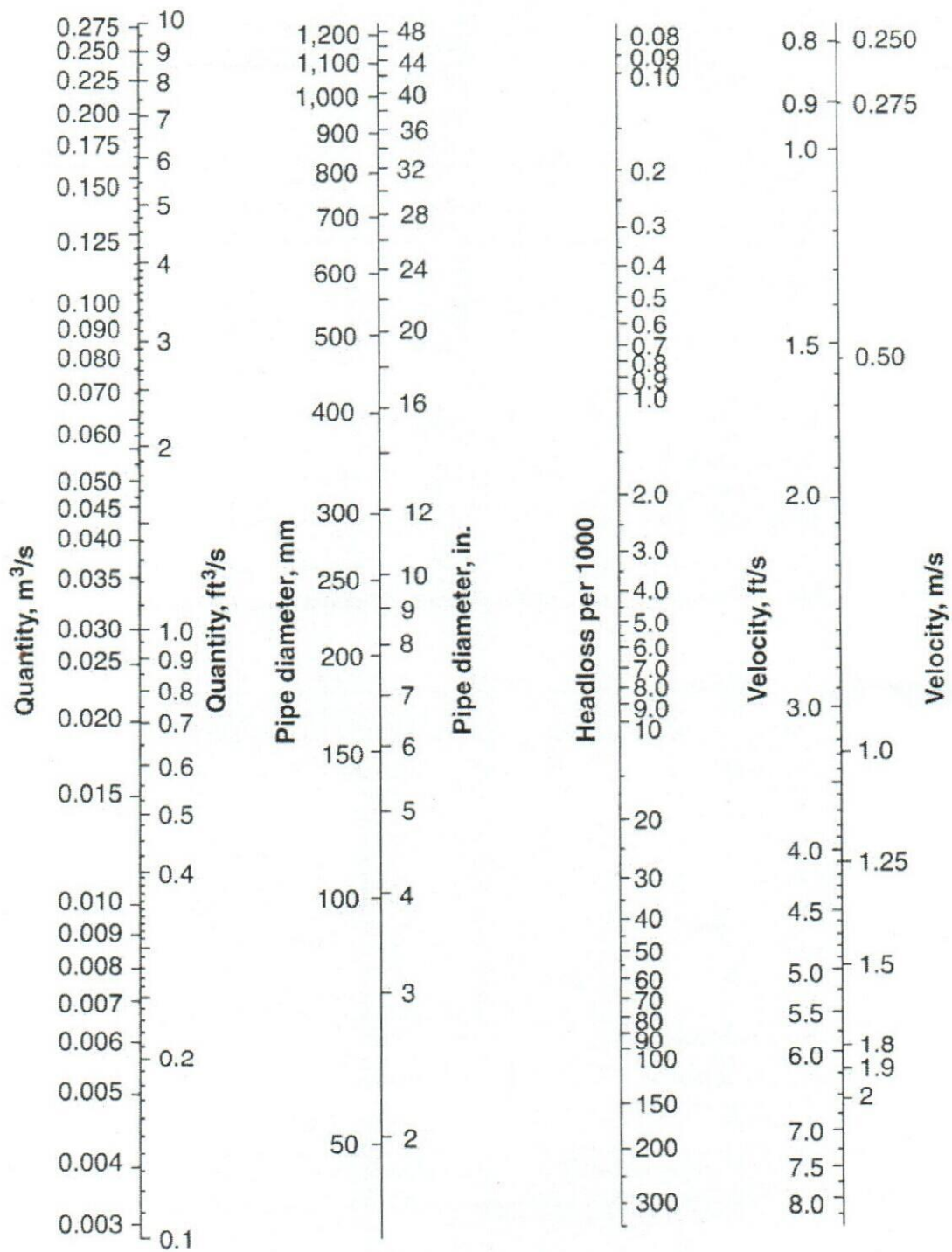


Figure 1: Nomograph providing a graphical solution to the Hazen Williams equation for water flowing in circular pipes under pressure at $C=100$

Faculty of Engineering & Technology

Bachelor of Science Honours in Engineering in Civil Engineering



CE4321 – Construction Engineering & Management

Final Examination

Module Leader: Mr. Kushan Hirimuthugodage

Date: 21st August 2024

Time: 0900 - 1200 hours

Instructions to Candidates:

- This is an **Open Book Exam**
- Use the Same booklet to answer Part **A** and Part **B**
- Suggested time period for Part **A** is 80 minutes and Part **B** is 100 minutes
- Write clearly and legibly with a blue or black pen.
- Write your name and student number on all sheets.

1. Installing an assembly line in a toy factory is a;
 - a. Project
 - b. Process
 - c. Operation
 1. a only
 2. b only
 3. c only
 4. a and b only
 5. b and c only
2. Which of the following statements are TRUE about productivity?
 - a. The main objective of work study is to improve productivity of workers, machines and materials
 - b. Predetermined Motion Time System (PMTS) is NOT a work measurement technique that analyzes the basic human movements
 - c. Work study helps to find the best method of performing by eliminating wastages
 1. a only
 2. a and b only
 3. a and c only
 4. b and c only
 5. All
3. Which of the following statements of FALSE regarding construction machines?
 - a. Forklift can lift one or few workers
 - b. Asphalt paving machine provides minor compaction before it is compacted by a roller
 - c. From a tunnel boring machine a specific excavation profile can be achieved
 1. a only
 2. b only
 3. c only
 4. a and b only
 5. b and c only
4. What is a similar name for Slack
 1. Float
 2. Buffer
 3. Lag
 4. Reserve
 5. Schedule

5. In a project the selected main contractor has to provide services needed by the nominated subcontractors and to do the coordination with them. For that the main contractor is paid with;
1. Nominated fee
 2. Subcontractor fee
 3. Nominated sub-contractor fee
 4. Attendance fee
 5. Coordination fee
6. You are managing a project that has a To-complete performance index (TCPI) of 0.98 What is the BEST course of action?
1. You're under budget, so you can manage costs with lenience
 2. Manage costs aggressively
 3. Create a new schedule
 4. Create a new budget
 5. Not Enough Data
7. You are the project manager of a multi-story building project and at the middle of the project the client wants to add a new car park which was not in the original design. But he needs to finish it with the completion of the other project. Which of the following tendering method will suite to the best;
1. Negotiated tendering
 2. Two stage tendering
 3. Open bid tendering
 4. Selective tendering
 5. Closed bid tendering
8. In which item of a BOQ describes the costs that cannot be apportioned in to measured work
1. Preliminaries
 2. Preambles
 3. Provisional Sums
 4. Contingencies
 5. Measured Works

9. Which of the following is TRUE about Near Miss?
- It is also known as Near Hit
 - It is an accident result in injury or damage
 - A Near Miss today can be tomorrow's accident
- a only
 - b only
 - c only
 - a and b only
 - a and c only
10. You are managing a project with a Budget at completion (BAC) of Rs. 93,000.00, Earned Value (EV) of Rs. 39,870.00, Planned Value (PV) of Rs. 64,800.00 and Actual Cost (AC) of Rs. 44,200.00. What is the Cost Performance Index (CPI)?
- 1.5
 - 0.9
 - 1.2
 - Rs. 9,000.00
 - Rs. 1.2
11. You are managing to build a bridge. You work with your team and come up with a most likely estimate of 26 weeks to complete the job. In the Best case the project can be completed in 23 weeks because they have some precast beams. But there is a risk of bad weather where the project can be delayed by three weeks than the most likely estimate. Use PERT (Program Evaluation Review Technique) to calculate the estimated duration for this project.
- 25.83 weeks
 - 26 weeks
 - 27 weeks
 - 27.5 weeks
 - 28.3 weeks

12. You are a project manager for a construction project and you work with your own work force of the company. But for electrical and plumbing works you do not have competent skill workers on the company. Because of that you are going to hire some subcontractors for that specific job. This is called;

1. Outsourcing
2. Referrals
3. Walk ins
4. Head Hunting
5. Offshoring

13. You are doing the Vendor Bid Analysis. Which Process Are you in?

1. Determining Budget
2. Controlling Costs
3. Estimating Costs
4. Cost Baselineing
5. Cost Evaluation

14. You are working on a project with an SPI of .72 and a CPI of 1.1. Which of the following BEST describes your project?

1. Your project is ahead of schedule and under budget
2. Your project is behind schedule and over budget
3. Your project is behind schedule and under budget
4. Your project is ahead of schedule and over budget
5. Not enough data

15. Estimated cycle time of an excavator which is going to be used in a bulk excavation project is calculated as 2 minutes. The capacity of the bucket which is going to be used is 0.4m^3 and the efficiency of the machine and the operator is estimated as 75%. Calculate the hourly production of the machine?

1. 7.25m^3
2. 8.00m^3
3. 8.25m^3
4. 9.00m^3
5. 9.25m^3

16. If the natural soil which is going to be excavated in Question 18 is having a compaction factor of 1.2, how many 1cube truck loads you need to transport the soil?

1. 3
2. 4
3. 5
4. 6
5. 7

17. Which one of the following is NOT an advantage of an orientation program?

1. It helps to understand about the organization
2. Feels welcome
3. Can get an idea about what is expected in work and behavior
4. Gives technical knowledge on what to do
5. It helps to start the socialization process

18. If Actual Cost (AC) is lower than your Earned Value (EV), what does this mean

1. The project is under budget
2. The project is over budget
3. The project is ahead of schedule
4. The project is behind schedule
5. Not enough data

19. If a worker is working at height with the full safety harness belt and lanyard of 6 feet length what should be the minimum height of the anchorage point to the floor level. Take height of the worker as 6 feet and safety factor as 3 feet and maximum deceleration distance as 3 feet.

1. 16.5ft
2. 17.0ft
3. 17.5ft
4. 18.0ft
5. Not enough data

20. Planned budget is a snapshot of.....

1. Life Cycle Costing
2. Internal Rate of Return (IRR)
3. Cost Baseline
4. Earned Value (EV)
5. Benefit Cost Ratio (BCR)

21. 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 $\Rightarrow$ b $\Rightarrow$ c $\Rightarrow$ d $\Rightarrow$ e
 - 2. a $\Rightarrow$ c $\Rightarrow$ b $\Rightarrow$ d $\Rightarrow$ e
 - 3. a $\Rightarrow$ c $\Rightarrow$ b $\Rightarrow$ e $\Rightarrow$ d
 - 4. a $\Rightarrow$ b $\Rightarrow$ c $\Rightarrow$ e $\Rightarrow$ d
 - 5. a $\Rightarrow$ c $\Rightarrow$ d $\Rightarrow$ b $\Rightarrow$ e

22. Which of the following statements are FALSE about earth moving machines?

- a. A Scraper is generally carried out on a downward gradient to take full advantage of gravity
- b. If the mould board can be tilted in the horizontal and vertical planes in a Dozer, then the machine is called an angle dozer
- c. Front Shovel pulls the material towards the machine

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

23. Which of the following is a project?

- a. Repairing a car
 - b. Running ready mix concrete plant
 - c. Building an extension for an existing factory
- 1. a only
 - 2. b only
 - 3. c only
 - 4. a and b only
 - 5. a and c only

24. Which of the following business organizations will NOT protect the owner's assets in the event of business fault or accident?

- a. Limited Liability
 - b. Sole Proprietorship
 - c. Partnership
- 1. a only
 - 2. b only
 - 3. c only
 - 4. a and b only
 - 5. b and c only

25. Which of the following is FALSE about legal system in Sri Lanka?

- 1. By Laws are regulations made by a local authority or corporation
- 2. Legislation is an act passed by the supreme court
- 3. The existing constitution of Sri Lanka has been formally amended 21 times as October 2022
- 4. Roman Dutch Law is the common law of our country
- 5. Judicial Precedent is called judge made law

26. You are the project manager of a multi-story building project and at the middle of the project the client wants to add a new car park which was not in the original design. But he needs to finish it with the completion of the other project. Which of the following tendering method will suite to the best

- 1. Negotiated tendering
- 2. Two stage tendering
- 3. Open bid tendering
- 4. Selective tendering
- 5. Closed bid tendering

Use this for Question No. 27 and 28

Activity	Duration(Weeks)	Predecessor
Start	-	-
A	4	Start
B	3	A
C	4	B
D	5	Start
E	8	D
F	7	B
G	6	D
H	4	E,G
Finish	-	C,F,H

27. What is the critical path in the activity list?

1. Start-A-B-C-Finish
2. Start-A-D-F-Finish
3. Start-D-E-H-Finish
4. Start-D-G-H-Finish
5. None of the above

28. What is the float for activity "F" in the activity list?

1. 0
2. 2
3. 3
4. 4
5. 6

29. You are a project manager of a site and you are asked to do a performance appraisal of a supervisor for the last year. You do it based on his work performance in the previous month only. Because of this that performance appraisal fails. This is called;

1. Halo effect
2. Central Tendency
3. Leniency
4. Bias
5. Recency error

30. Which is FALSE about organization structures?

1. Flat organizations are also described as self-managed
2. Flat organizations are delay decision-making processes
3. Functional Organizations Divides a firm's operations based on specialties
4. In a Matrix organization there is more than one line of reporting managers
5. In Matrix organizations, the employees are accountable to more than one boss

31. You are a newly appointed engineer for a construction project. From the first day you have been given lot of responsibilities, without telling the procedures to follow. Because of this you are very stressed and now you are thinking of leaving the company. what is the Feyol's Management Theory that your company should follow to retain you

1. Unity of command
2. Unity of direction
3. Scalar chain
4. Order
5. Stability of tenure personnel

32. Which of the following statements are FALSE about soil compaction?

- a. In the case of large lift thickness, bridging may occur at the top of lifts
- b. When the soil starts to crack, it means you need some more roller passes
- c. At site you use 75% of the ideal maximum lift thickness provided by the machine manufacturer

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

33. Which of the following are fundamental element of a contract?

- a. Legality of objects
- b. An offer and an acceptance
- c. Capacities of parties
 - 1. a only
 - 2. a and b only
 - 3. a and c only
 - 4. b and c only
 - 5. All

34. You are doing the Vendor Bid Analysis. Which Process Are you in?

- 1. Determining Budget
- 2. Controlling Costs
- 3. Estimating Costs
- 4. Cost Baselineing
- 5. Cost Evaluation

35. Which of the following statements are TRUE;

- a. Crashing the project adds risk, while fast-tracking adds cost
- b. Crashing the project adds cost, while fast-tracking adds risk
- c. When you crash a project, it always shortens the total duration of the project
 - 1. a only
 - 2. b only
 - 3. c only
 - 4. a and b only
 - 5. b and c only

36. Your company has asked you to provide a cost estimate that includes maintenance, installation, support, and upkeep costs for as long as the product will be used. What is that kind of estimate called?

- 1. Benefit-cost ratio
- 2. Depreciation
- 3. Net present value
- 4. Lifecycle costing
- 5. Earned value management

37. Which of the following is FALSE about a Functional Organization?

1. Work is performed more efficiently since each manager is responsible for a single function
2. The employees are accountable to more than one boss
3. Delay in decision-making
4. Divides a firm's operations based on specialties and there's an individual in charge of a particular function
5. There's a total specialization of work

38. Which of the following are advantage of Tendering Process?

- a. Allow for competition
 - b. Neglect small contractors
 - c. Prevents frauds
1. a only
 2. b only
 3. c only
 4. a and b only
 5. a and c only

39. Which of the following are TRUE regarding individual's response for change?

- a. People always motivated with the change
 - b. People sometimes get new opportunities with change and they think it will be better
 - c. People can be confused and scared
1. a only
 2. a and b only
 3. a and c only
 4. b and c only
 5. All

40. Which of the following Techniques that you can use to manage quality?

- a) 5S
- b) Three MU's
- c) Standardization
 - 1. a only
 - 2. a and b only
 - 3. a and c only
 - 4. b and c only
 - 5. All

(1.25x40=50 Marks)

Part B

1. You are a newly appointed safety of a pilling company. You are going to start a pilling job for a multi-story building. You need to identify **Two** safety hazards that can happen at each the following stages of the site progress and the safety measures that you can take to avoid them.
 - i. Site planning
 - ii. Site Mobilizing
 - iii. Pilling boring and concreting
 - iv. Pile Hacking

2. JKH is a construction company engaged in land reclamation projects. They decided to buy an JCB machine for their project for Rs. 15,000,000.00. They were able to negotiate with a leasing company to fund 75% of the amount of the machine with an annual interest rate of 8% which is fixed for all 5years. The interest is equally calculated to the capital on every year for the lease period of 5 years.

In addition to all these JKH needs to pay Rs. 400,000.00 as a heavy vehicle tax for the government every year for all 5 years. They also arranged an insurance with a premium of Rs. 200,000.00 per year for all 5 years.

JKH is expecting to sell the machine after 5 years with a salvage value of Rs. 5,000,000.00 and the company accountant is using Sum of Digits method to calculate the depreciation for the machine. The fuel consumption of the machine is 5l/hr and the lubricant consumption is 0.25l/hr. Assume that these consumptions and the tyres unchanged for the all 5years. The machine is expected to work an average of 6 hours per day for 300 days in a year for all 5 years.

(Additional data: fuel price Rs.400.00/per liter, Lubricant price Rs.800.00/per liter, repair cost Rs. 500.00/per hr, operator wages Rs. 700.00/per hr. Assume all these prices will not change for all 5 years)

Help the newly appointed Project manager to find the following for the 3rd year of machine operations;

- I. Machine Fixed cost
 - a) Depreciation
 - b) IIT
- II. Machine variable cost
 - a) Operator Wages
 - b) Fuel
 - c) Lubricant and Filter
 - d) Repair and Maintenance
 - e) Tyre
- III. Total Owning and Operating Cost

3. You are a newly appointed project manager multi story construction project. When you start work, you realized that there are issues with the quality management process of the site. There are lot of wastages and miss use of machineries. You are planning to introduce continuous quality improvements to the site using **Kaizen approaches**. Discuss **Three** techniques that you can use with **examples**
4. You have recently joined to a construction company where they are using out dated technology at their construction sites. The workers also using old methods of doing work which consumes more time. Based on the knowledge that you gained during the university, describe what are the methods that you can use to improve productivity at your new company. (Discuss **three** methods with **examples**)
5. You are the Human Recourse (HR) manager of a construction company. You are asked to hire a new senior project manager for a new upcoming project. Instead of hiring a new one you have suggested to appoint a junior project manager who is performing well. Discuss advantages and disadvantages of hiring an internal candidate (**Discuss three advantages and three disadvantages**)

(10x5=50 Marks)