UNIVERSITY OF RUHUNA

Faculty of Engineering

End-Semester 1 Examination in Engineering: October, 2022

Module Number: CE1202 **Module Name: Introduction to Infrastructure Planning**

[Three Hours]

[Answer all questions. Each question carries **FIFTEEN** marks]
All Standard Notations denote their regular meanings

Q1. a) Name the main three branches of civil engineering systems based on the facility provided by that system. Give one example for each branch.

[3.0 Marks]

b) Any system can be defined as "a collection of regularly interacting or interdependent interrelated objects and/or rules, real or abstract, that collectively respond to some external action or serve a certain function". Based on this definition, discuss the components (both physical and non-physical) of a transportation system.

[3.0 Marks]

c) The construction of a civil engineering system mainly considers the following four aspects.

- application of scientific tenets
- broad range of criteria
- optimization of resources
- ethical responsibility

Considering a road construction project in an urban area, explain how above aspects should be incorporated in the project.

[4.0 Marks]

d) Structural elements can be in one form of linear, surface or volume. Name one example for each of the above categories.

[2.0 Marks]

e) Define the following terms giving an example for each.

i Tension member
ii Compression member
iii Flexural member

[3.0 Marks]

Q2 a) Consider the domestic building plan given in Figure Q2.

i Give appropriate names for the activity spaces demarcated in letters A to G.
ii Draw the bubble diagram to show the connectivity of the activity spaces given in Figure Q2.

[4.0 Marks]

b) Explain with examples how the following factors affect to the planning of a domestic building.
   i Client's requirements
   ii Materials availability
   iii Rules and regulations

[4.5 Marks]

c) Explain five features that need to be considered in selecting a land for building construction.

[2.5 Marks]

d) Draw with dimensions, the elevation view, and plan views of two consecutive layers for a 9″ thick brick wall constructed using English bond pattern.

[4.0 Marks]

Q3. a) Briefly compare and contrast the following pairs of terms in relation to Engineering Surveying.
   i Ordinance Bench Mark and Temporary Bench Mark
   ii Level line and horizontal line
   iii Triangulation and trilateration
   iv Backsight and foresight

[4.0 Marks]

b) The recorded levels during a levelling exercise which ran between TBM1(124.670 m AMSL) and TBM2(123.910 m AMSL) are shown in Table Q3. Determine the corrected reduced levels of all points by the rise and fall method, stating all the necessary checks.

[11.0 Marks]

Q4. a) It is needed to determine the length of the survey line running across a wide river. Explain how the length can be determined by the fact that the river is too wide to be measured by a single tape measurement and clear visibility is available.

[3.0 Marks]

b) A survey baseline was measured in catenary in four bays. The average lengths of the four bays are 25.730, 28.875, 25.445, and 19.346 m. The differences at the start and end of each bay were 0.34, 0.60, 0.70, and 0.55 m respectively. The length of the line was measured by using a tape having a nominal length of 30 m. Determine the corrected length of the baseline considering the following data.

- Actual length of the tape is 30.20 m
- Temperature during the observations was 23°C
- Tension applied was 25 kg force
- The tape was standardized at 20°C, on the flat with a tension of 10 kg force.
- The coefficient of expansion was 0.000011 per °C,
- The mass of the tape is 1 kg,
- The cross-sectional area is 3 mm^2.
- E = 210 kN/mm^2,
- The gravitational acceleration g = 9.80665 m/s^2

[12.0 Marks]

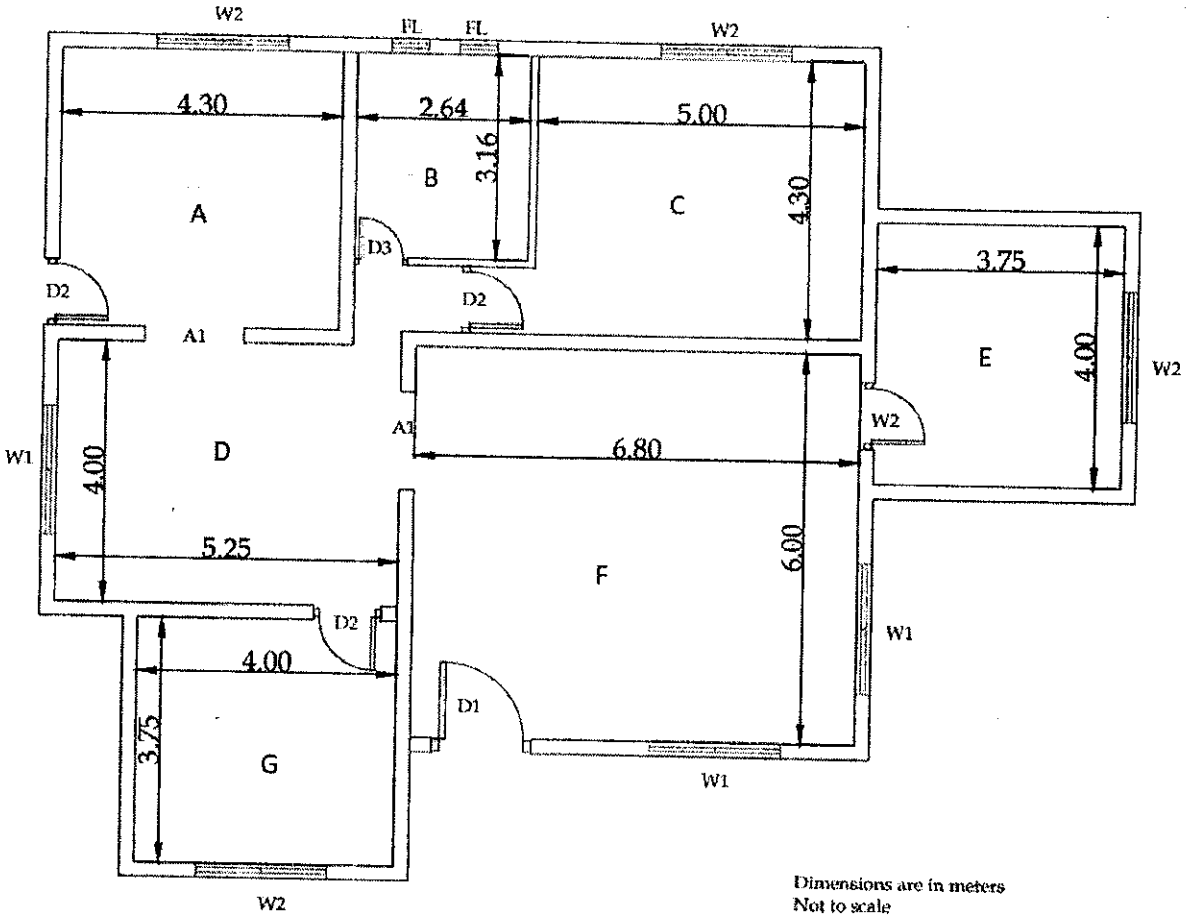

Figure Q2: Plan of a Domestic Building

Table Q3: Level book

BS	IS	FS	Remarks
2.305			TBM1
	2.875		CL 10
	2.890		CL 20
	3.065		CL 30
3.500		1.605	CP1
	2.450		CL 40
	3.320		CL 50
2.790		3.670	CP2
	2.000		CL 60
	1.760		CL 70
		4.050	TBM2

Useful Equations

$$t_a = \frac{C_t}{KL} + t_s$$

$$C_t = KL\Delta t$$

$$E_F = \frac{K_1E_A + K_2E_B + K_3E_c}{K_1 + K_2 + K_3}$$

$$N_F = \frac{K_1N_A + K_2N_B + K_3N_c}{K_1 + K_2 + K_3}$$

$$\sigma_{\bar{x}} = \frac{S}{\frac{1}{n^2}}$$

$$C_T = L\ \frac{\Delta T}{AE}$$

$$C_\theta = -\frac{h^2}{2L}$$

$$C_M = -\frac{LH}{R}$$

$$k = \frac{AB_S}{AB_U}$$

$$\theta = (\emptyset_{AB})_S - (\emptyset_{AB})_U$$

$$S = \left(\frac{\sum(x_i - \bar{x})^2}{n-1}\right)^{\frac{1}{2}}$$

$$C_s = -\frac{w^2L^3}{24T^2}$$

$$C_s = -\frac{w^2L^3}{24}\left(\frac{1}{T_A^2} - \frac{1}{T_S^2}\right)$$

$$K_1 = \frac{1}{(\cot a - \cot x)}$$

$$K_2 = \frac{1}{(\cot b - \cot y)}$$

$$K_3 = \frac{1}{(\cot c - \cot z)}$$

$$C_\theta = -L\,(1 - cos\theta)$$

$$W \propto \frac{1}{\sigma_x^2}$$

$$(E_i)_S = (E_0)_S + k[(E_i)_U\ cos\theta + (N_i)_U\ sin\theta]$$

$$(N_i)_S = (N_0)_S + k[-(E_i)_U\ sin\theta + (N_i)_U\ cos\theta]$$