



**PNG UNIVERSITY OF TECHNOLOGY**

**DEPARTMENT OF CIVIL ENGINEERING – 3<sup>rd</sup> YEAR DEGREE**

**SECOND SEMESTER EXAMINATIONS – 2021**

**CE 323 STRUCTURAL DYNAMICS AND EARTHQUAKE ENGINEERING**

**DATE: Monday, 1<sup>st</sup> November 2021**

**ROOM: Structures Lecture Theatre (SLT)**

**TIME: 08:30 a.m.**

**TIME ALLOWED: 3 Hours**

**INFORMATION FOR CANDIDATES.**

1. You have 10 minutes to read the Paper. You must not begin writing during this time.
2. Answer any five (5) questions out of seven (7).
3. All answers must be written on the answer book provided. No other written material will be accepted.
4. Write your name and number clearly on the front page. Do it now.
5. Calculators may be used. Notes and text books are not allowed.

**Marking Scheme**

6. All Questions carry equal marks.

Instruction: Do five (5) Questions only out of seven (7).

**QUESTION ONE.**      Origin of Earthquakes.

1. Earthquakes are either natural or manmade. Give and briefly describe one example each of:
  - i) a man-made earth quake, and,
  - ii) a natural earthquake.
  
2. Describe the following terms as they are related to EQs:
  - i) Epicenter;
  - ii) Hypocenter;
  - iii) Intermediate earthquake;
  - iv) Focus of an EQ.

**QUESTION TWO**      Measurement of Earthquakes

1. Describe how the Magnitude of an Earthquake is measured.
2. Describe how the Intensity of an Earthquake is measured.
3. What is a Seismometer and what is its purpose? Where would you find a Seismometer in PNG?

**QUESTION THREE**

1. What effect does the presence of a structure on site have on an Earthquake?
2. What Philosophy is used in most building Codes for earthquake resistant design of structures?

**QUESTION FOUR**

1. Describe the elastic response and elasto-plastic responses are of a single degree of freedom resonator. You may use sketches/graphs to explain your answer.
2. Describe what the Ductility of a structure is.
3. Describe what a beam sidesway mechanism is for a multi-storey building structure. What is the purpose of this mechanism?

**QUESTION FIVE**

The total horizontal seismic load (the base shear) is given by the equation

$$V = C * I * K * W_t.$$

Define each of the symbols used in the equation.

**QUESTION SIX**

The equivalent Static Load Analysis is used to distribute the Base Shear (or total lateral) Force along the height of the structure. The building structure in **Figure Q6** is loaded at each floor as shown. The load consists of Dead and Reduced Live load only.

- (i) Determine the total base shear due the floor loads;
- (ii) Distribute the base shear,  $V$ , as lateral loads at each floor level;
- (iii) Calculate the over-turning moment about the ground floor level.

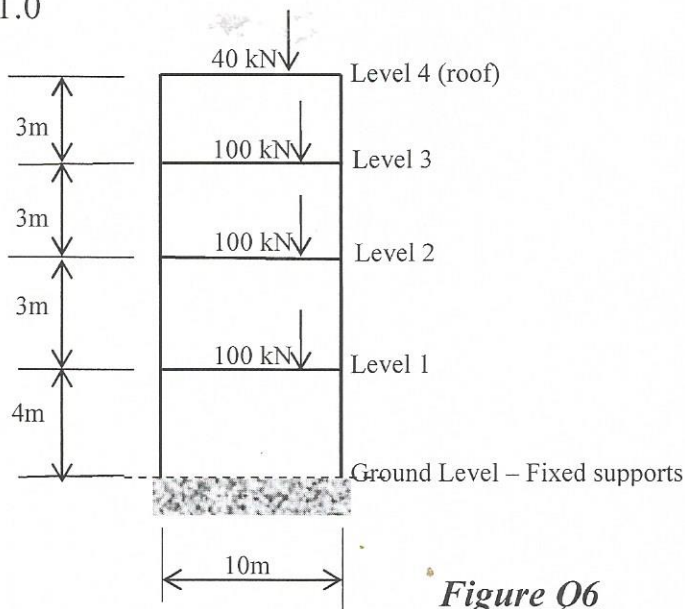
Information. Values of the coefficients are as follows:

$$T = 0.06 * H^{0.75}$$

$C$  from Figure 3.3(attached) for Zone 2 and firm on ground.

$$I = 1.5$$

$$K = 1.0$$



**Figure Q6**

**QUESTION SEVEN**

1. Describe what the P-delta effect is on a building structure. When is it necessary to take this into account or consideration in the design of the structure?
2. Describe two methods for providing lateral restraint on a structure.
3. Why is it necessary to provide lateral resistance in the two perpendicular directions?

***END of EXAM.***

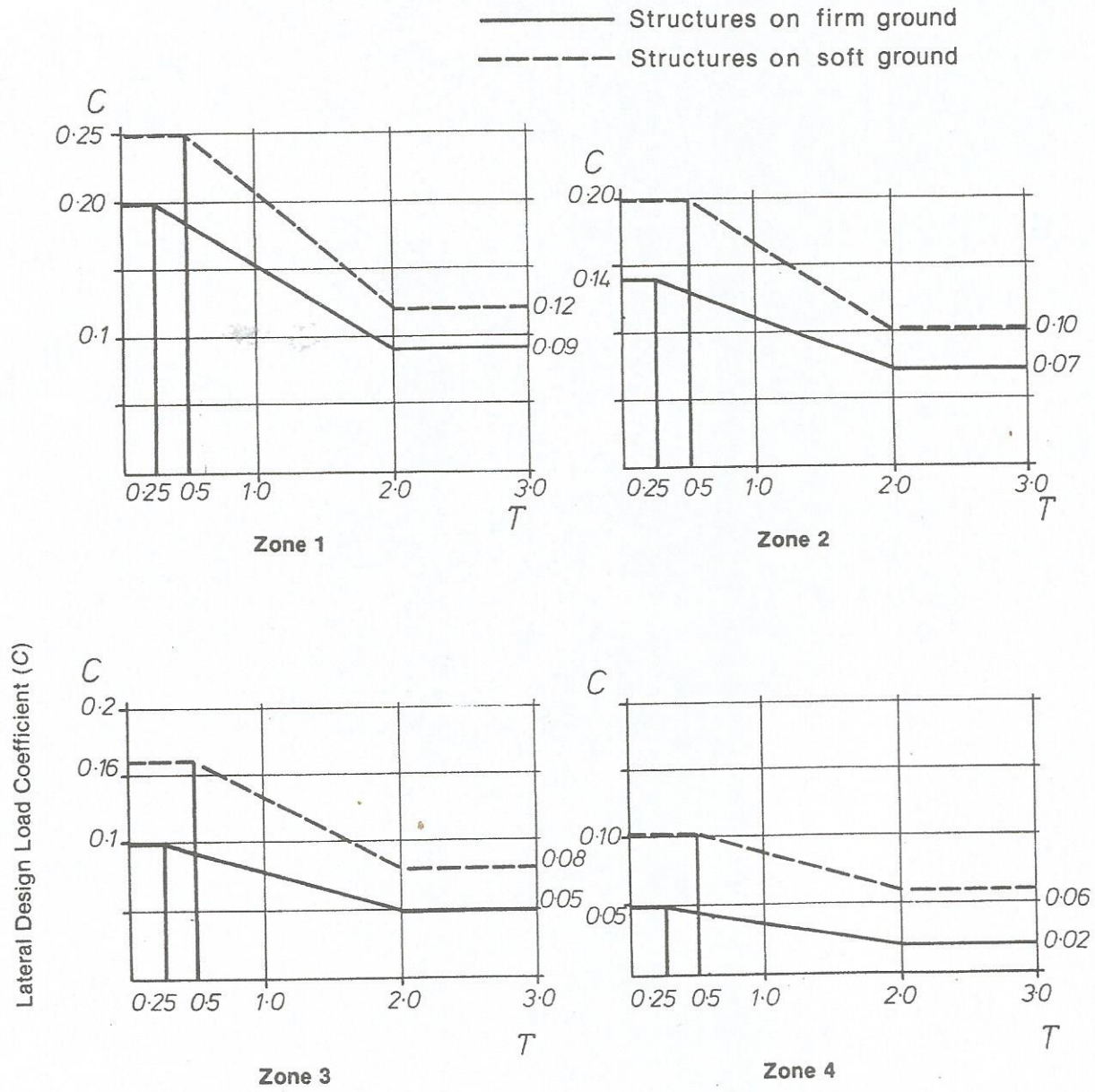


Fig. 3.3. BASIC SEISMIC COEFFICIENT C