



THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY
DEPARTMENT OF CIVIL ENGINEERING – 3RD YEAR DEGREE

SECOND SEMESTER EXAMINATIONS - 2022

CE 323 – STRUCTURAL DYNAMICS & EARTHQUAKE ENGINEERING

DATE: MONDAY, 24TH OCTOBER 2022 – 08:20 A.M

VENUE: STRUCTURES LECTURE THEATRE (SLT)

TIME ALLOWED: 3 HOURS

INFORMATION FOR CANDIDATES

1. You have 10 minutes to read the paper before the examination starts. You must **not** begin writing during this time.
2. **There are EIGHT (8) Questions in this paper. Answer ALL questions.**
3. Use only ink. Do not use pencils for writing except for drawings and sketches.
4. Only Calculator is allowed in the examination room. MOBILE PHONE is not allowed (**Switch your Mobile Phones OFF**). Notes and textbooks are not allowed.
5. Start each question on a new page and show all your calculations in the answer book provided. No other material will be accepted.
6. **Write your NAME and Student NUMBER clearly on the front page.**
Do it now.
7. **Marking Scheme:** All Questions carry equal marks of 10.

Question One [Origin of Earthquakes]

- a) Earthquakes are either natural or manmade. Describe the following with one example each of:
- A manmade earthquake, and
 - A natural earthquake.
- b) Describe the following terms as they are related to earthquakes;
- Epicentre
 - Hypocentre
 - Tectonic Plate, and
 - Lithosphere

Question Two

- Describe how the Magnitude of an Earthquake is measured.
- Describe how the Intensity of an Earthquake is determined.
- What is a Seismometer and what is its purpose? Where would you find a Seismometer in PNG?
- What is the purpose of including a damping mechanism in the design of an Earthquake-resistant structure?
- Describe what "free vibration" is for a single degree of freedom structure.
- What is the purpose of having, in Plan view, a symmetrical arrangement of the bracing system in a structure in both (perpendicular) directions?

Question Three

- What effects does the presence of a structure on a site have on an Earthquake?
- What is the Philosophy used in most building Codes for Earthquake resistant design of structures?

Question Four

- Describe the following responses of a single degree of freedom resonator:
 - Elastic response;
 - Elasto-plastic response

Question Five

- Describe the "Quasi-static load method" of analysis for a high-rise building structure. What does it involve for an earthquake ground/base excitation?
- 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 [Multi-storey Structures]

1. Design procedure for a Steel structure: List down 3 of the stages involved in the design procedure for a steel structure.
2. Design procedure for a Timber structure: List down 3 of the stages involved in the design procedure for a Timber structure.
3. Design procedure for a Reinforced Concrete structure: List down 3 of the stages involved in the design procedure for a Reinforced Concrete structure.

Question Seven

1. In determining a building layout, what are the advantages of a simple symmetrical structure?
2. In a strong column-weak beam structure, state the advantage of this concept.
3. For a multi-storey, illustrate, by sketch, the weak storey concept.

Question Eight

A steel building structure is shown in the **Figure Q8**, below. The weight of each floor is shown on the structure. The column stiffnesses are also given.

- a) Determine the seismic base shear of the structure
- b) Determine the horizontal load for each floor level using the Equivalent static load method.
- c) Calculate the horizontal displacement of each level.
- d) Calculate the P- Δ effect moments, for the multi-storey structure

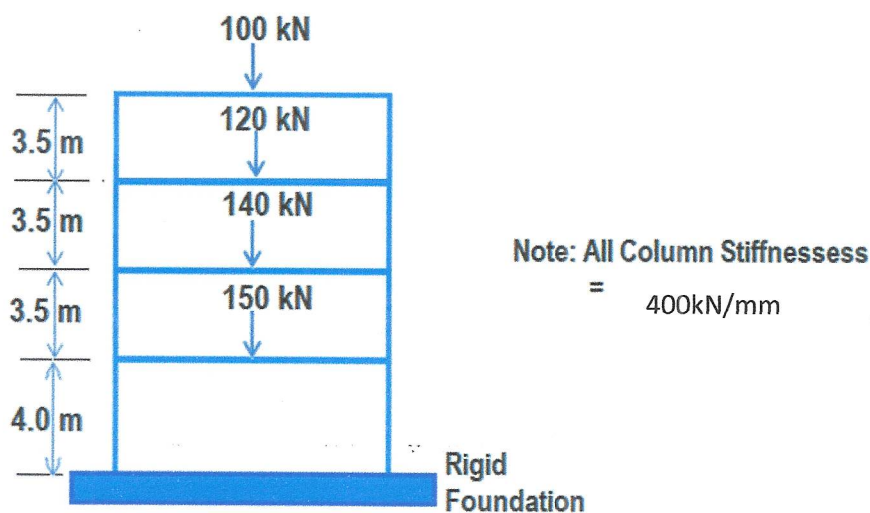


Figure Q8