UNIVERSITI SAINS MALAYSIA

KSCP Examination
2016/2017 Academic Session

August 2017

EAS664 – Principle of Structural Design

Duration : 2 hours

Please check that this examination paper consists of **SIX (6)** pages of printed material before you begin the examination.

Instructions : This paper consists of **FOUR (4)** questions. Answer **ALL** questions.

1. [a] Tall building is susceptible to horizontal forces; wind and earthquake loadings. Compare the design procedures between wind and earthquake actions on a building.

[5 marks]

[b] A 20-storey rigid frame building with setback as shown in **Figure 1** is located in Zone 1 with terrain category 2. The interstorey height is 3 m. Calculate the value of the design wind pressure on the wind ward direction at the top floor of the frame as shown in **Figure 1** according to MS1553:2002. Please indicate all assumed values used in the calculations. Design data can be extracted from MS1553 (2002).

[20 marks]

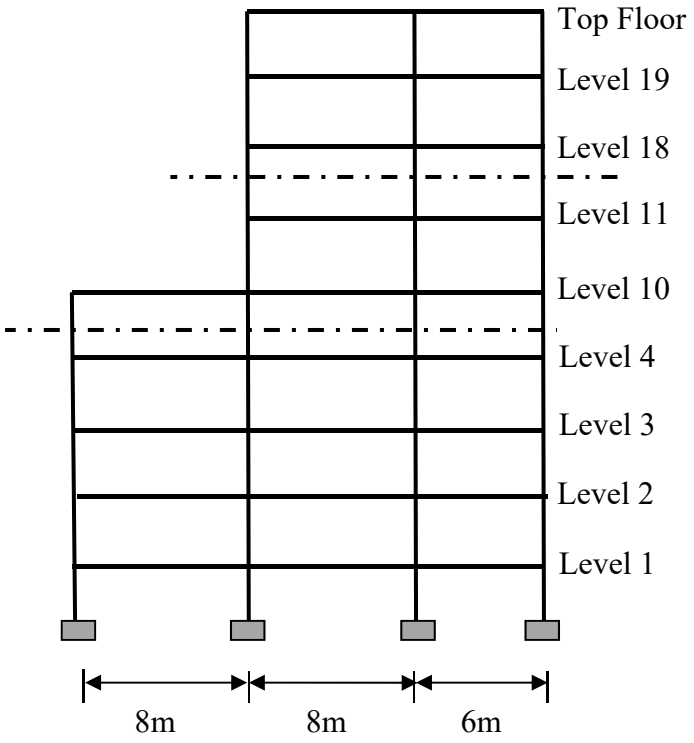


Figure 1

2. [a] Describe the Rigid Frame Structures, Braced Frame Structures, One way steel framing floor systems and Composite Steel-Concrete Floor systems in a high-rise building.

[8 marks]

[b] A 15-storey rigid frame structure is shown in **Figure 2** with intensity of wind loading of 1.5 kN/m^2 throughtout the height. The frame spans 6 m and the typical storey height is 3 m, to give a total height of 45 m. The frames are spaced at 6 m. Determine the member forces and moments of the top floor using Cantilever Method and the 13th floor using Portal Method.

[17 marks]

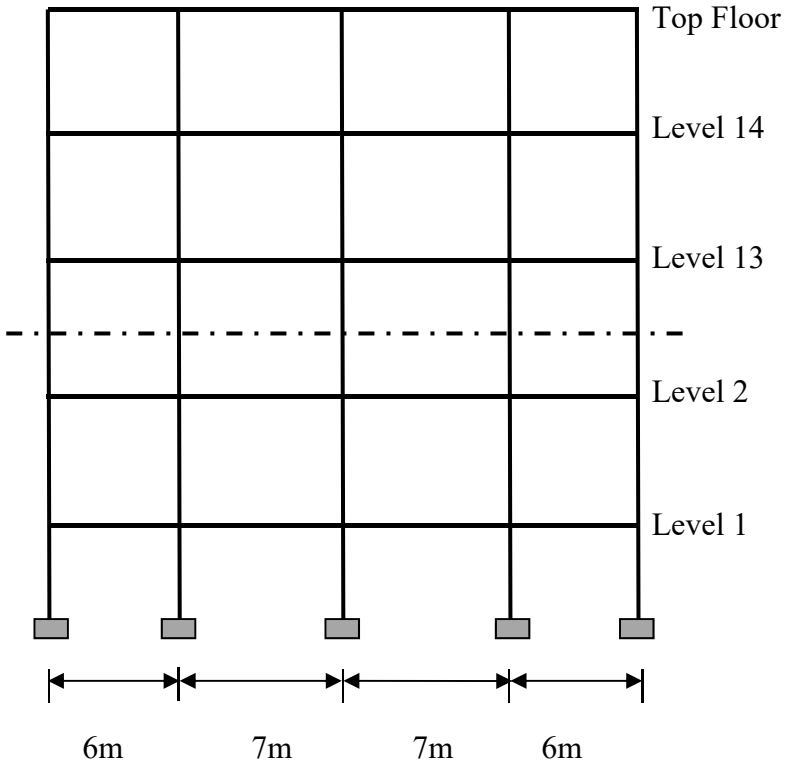


Figure 2

3. [a] The section of the steel beam for a frame is shown in **Figure 3**. Determine the plastic moment capacity, elastic moment capacity and shape factor of the beam section. The yield stress of steel is 275 N/mm^2.

[10 marks]

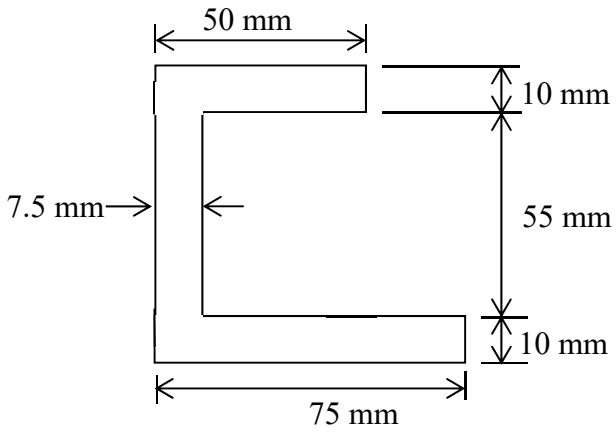


Figure 3

[b] **Figure 4** shows a rigid-jointed frame carrying the working loads. If the collapse load factor is to be 1.5, determine the required plastic moment capacity (M_p) for the frame.

[15 marks]

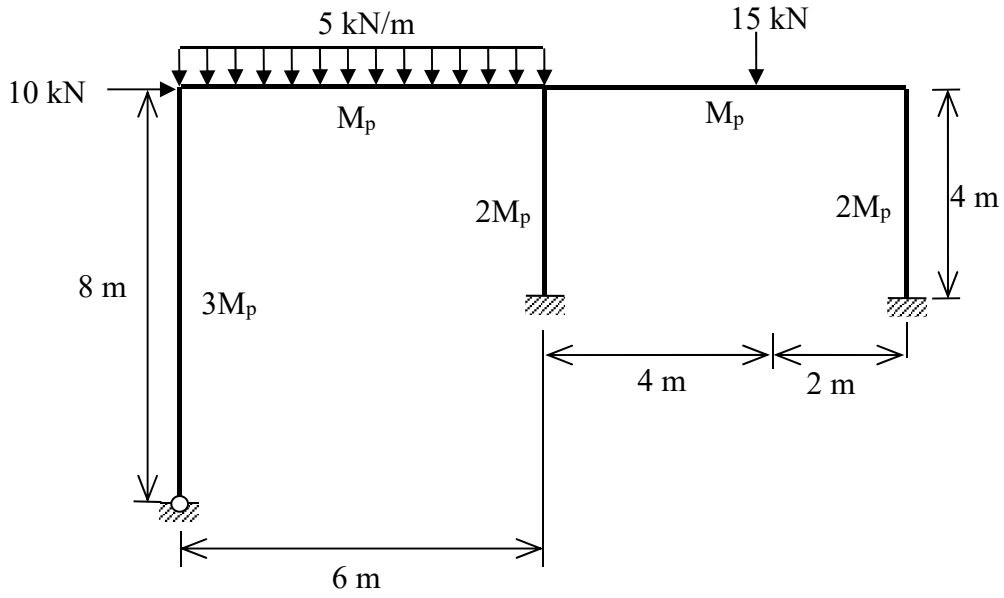


Figure 4

4. [a] Use the virtual work method, analyse a rectangular reinforced concrete slab of 12 m by 8 m which has two simply supported edges and two fixed edges and carries an ultimate uniformly distributed load w = 10 kN/m^2 as shown in **Figure 5**.

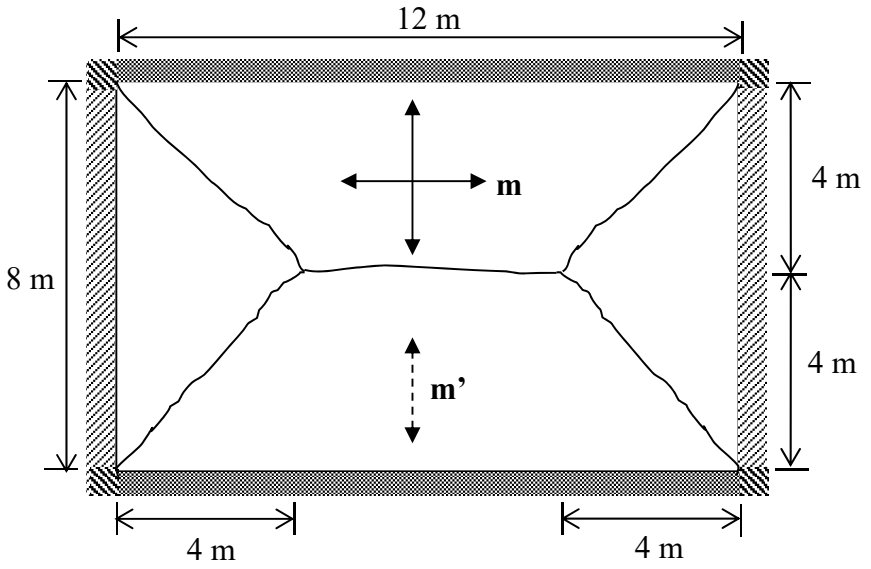
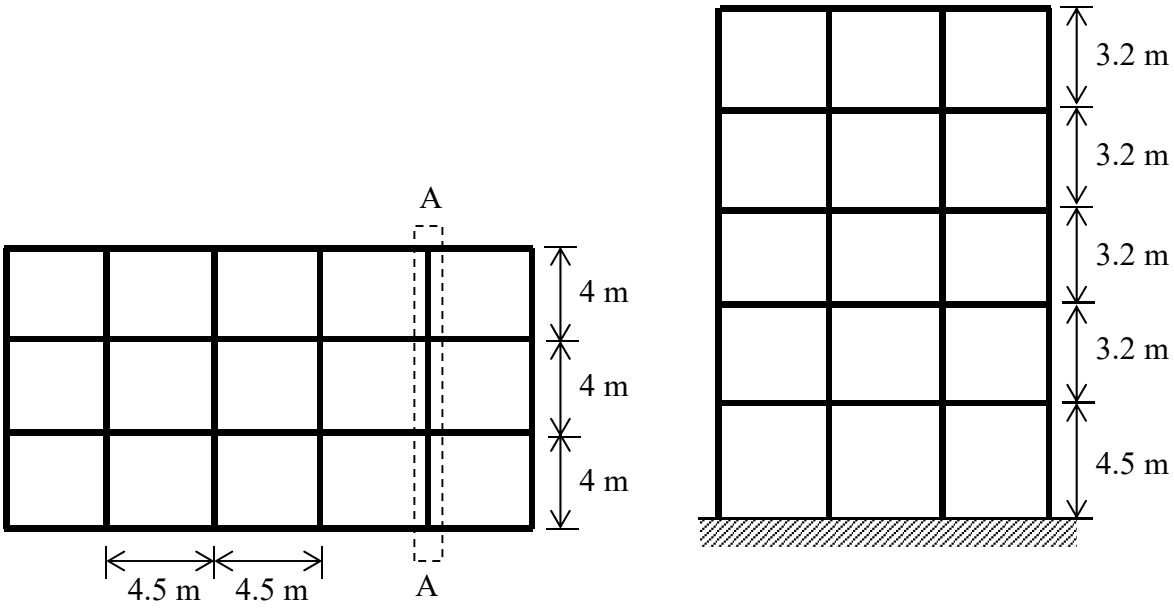


Figure 5

[10 marks]

[b] **Figure 6** shows a reinforced concrete framed building. The beams are 125 mm wide by 230 mm deep. Column sections are 230 mm by 230 mm elsewhere. The dead load per unit area of floor slabs (125 mm thick) including screeding and plastering is 4.8 kN/m^2. Assume full height brickwall of 115 mm thick is constructed on the beams from the ground to third floors. The density of reinforced concrete and brickwall are 24 kN/m^3 and 18 kN/m^3, respectively. The building has 5% damping, meeting Ductility Class Medium (DCM) and subjected to peak ground acceleration of 0.12g. The average shear wave velocity for the top 30 m of the ground is 200 m/s. The land is having a surface wave magnitude smaller than 5.5. The known seismic source is located more than 100 km away from the site. Determine the seismic forces for Frame A-A in accordance with EC8.

[15 marks]



Plan Elevation

Figure 6

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