TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF BUILDING & CIVIL ENGINEERING
UNIVERSITY EXAMINATION FOR:
BACHELOR OF SCIENCE IN CIVIL ENGINEERING

ECE 2514: THEORY OF STRUCTURES VII
SPECIAL/SUPPLEMENTARY EXAMINATION
SERIES: SEPTEMBER 2018
TIME: 2 HOURS

Instructions to Candidates:

1. You should have answer booklet for this examination.
2. This paper contains **FOUR** questions
3. Answer question **ONE** any other **TWO** questions.

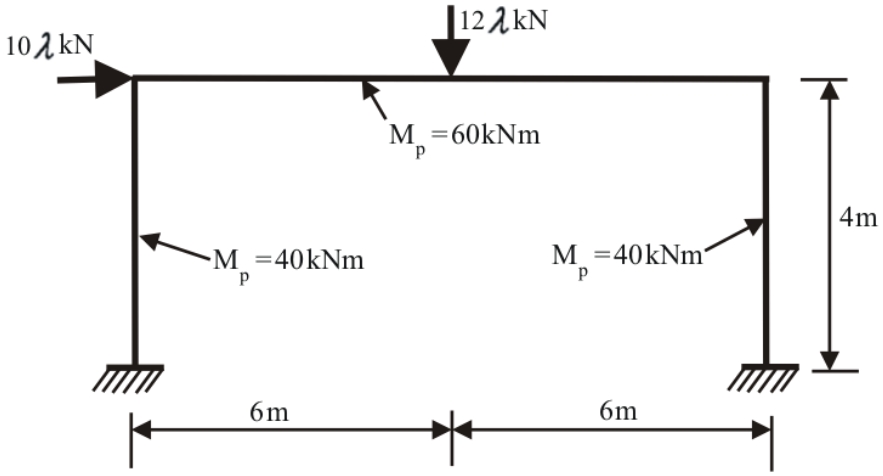
Question One (Compulsory) 30 marks

a) Using the Moment-Rotation Curve briefly explain the following stages of Cross Section Behaviour

- Stage 1 – Elastic Behaviour
- Stage 2 – Yield Moment
- Stage 3 – Elasto-Plastic Bending
- Stage 4 – Plastic Bending
- Stage 5 – Strain Hardening

(10 marks)

1. b) The management of Technical University of Mombasa is planning to build new Engineering workshops part of a frame in one of the bays is shown in the figure 1 below. Determine the collapse load factor λ of portal frame, hence draw the collapse bending moment diagram with $M \leq M_p$.



(20 marks)

Fig. 1

ANSWER ANY TWO QUESTIONS

Question Two (20 marks)

The County Government of Mombasa is planning to build new administration block for the governor, part of the beam in one of the bays is shown in the figure 1 below. Determine the required value M_p if the collapse load factor $\lambda = 1.7$

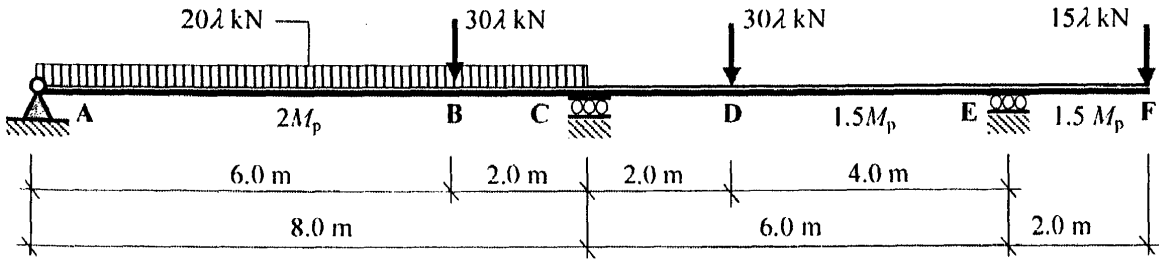


Fig. 2

(20 marks)

Question Three (20 marks)

a) i) Briefly explain the theorems of plastic analysis using the necessary conditions for plastic analysis. (6 marks)

ii) Determine the shape factor for the sections shown in figure 3

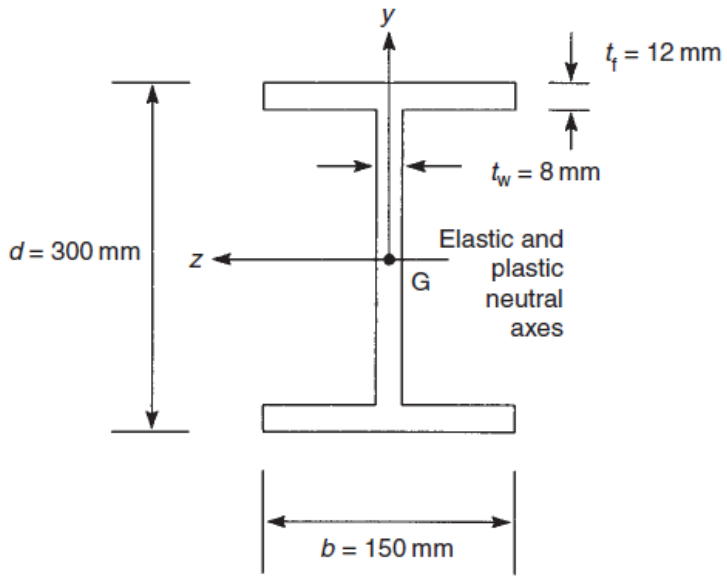


Fig. 3

(5 marks)

b) Oblique frame is loaded with working loads as shown figure 4:

i) Find the value of the collapse load factor when $M_p = 120\,kNm$

ii) Show that your solution is the unique solution;

iii) Sketch the bending moment diagram at collapse, showing all important values.

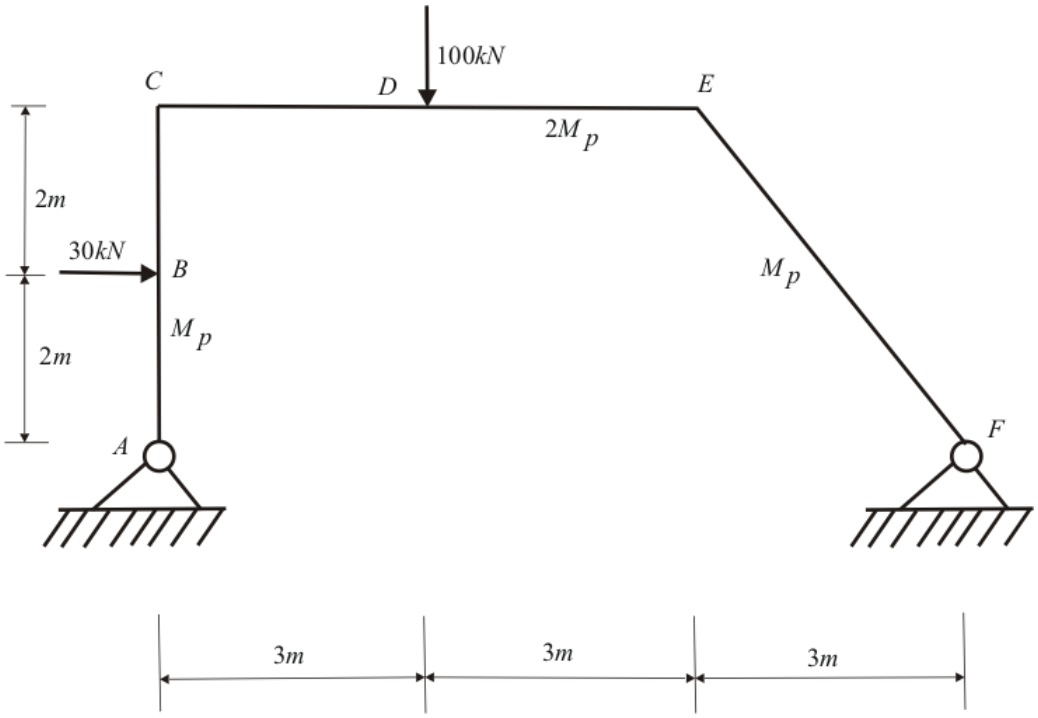


Fig.4

(9 marks)

Question Four (20 marks)

a) i) Briefly explain the principle of virtual work. (4 marks)

ii) Outline the advantages of Yield Line over Linear Elastic Analysis (2 marks)

iii) State THREE limitations of yield line method (3 marks)

b) A simply supported slab is shown in figure 5 below. If the designs load for the ultimate limit state is $10\,kN/m^2$. Determine the collapse load factor (11 Marks)

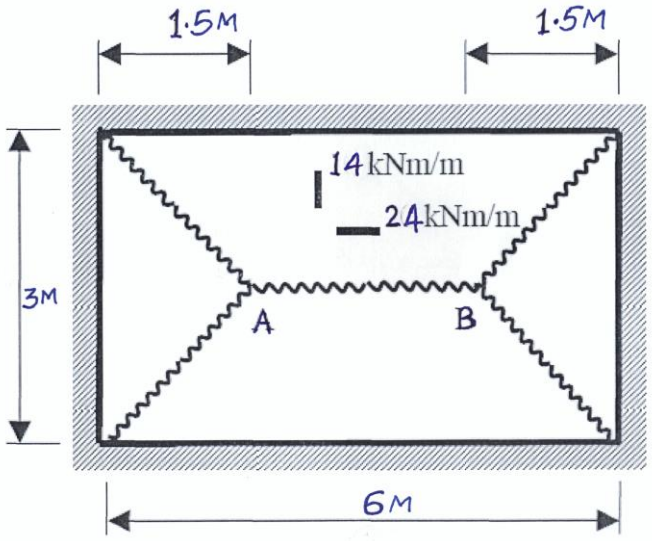


Fig. 5