NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
FACULTY OF INDUSTRIAL TECHNOLOGY
DEPARTMENT OF CIVIL AND WATER ENGINEERING
BACHELOR OF ENGINEERING (HONOURS) DEGREE
PART III SUPLLEMENTARY EXAMINATION – AUGUST 2011
STRUCTURAL ANALYSIS II – TCW 3207

INSTRUCTIONS

Answer all questions. Each question carries 25 marks

Time: 3 Hours
Total Marks 100

Q1

(a)Determine the shape factor for the section shown in Fig 1.1. [12]

(b) A beam is loaded as shown in Fig 1.2. It is made of an 'I' section of mild steel having a shape factor of 1.15 and a yield stress of 240MN/m^2. Using a load factor against collapse of 2, determine the required section modulus. [13]

Q2

(a) The portal frame shown in Fig 2.1 is fixed to its foundations and carries loads as shown. The relative values of the plastic moment of resistance are those given in the diagram. It is fabricated from members of a uniform section. Draw all the possible collapse mechanisms. Determine the plastic moment of resistance of the frame. [25]

Q3

(a) A rectangular isotropic plate measuring 8000mm by 4000mm is elastically fixed on two opposite edges along the y- axis. It is simple supported on the other edge and the remaining one is free. It carries a uniformly distributed load in the x and y directions. Indicate the Dirichlet boundary conditions for the plate for all the edges. [6]

(b) A reinforced concrete slab is shown in Fig 3.1. It is reinforced such that the hogging moment of resistance at all the built edges is 1,3m. The sagging moments of resistance are as shown in the figure. If the ultimate load design is 10kN/m^2, determine the required value of the moment parameter. [19]

Q4

(a)What is stochastic response in dynamic loading? [4]

(b)State the differences between structural dynamic and static loading structural systems. [4]

(c)The periodic loading of Fig 4.1 can be expressed by the cosine series given by;

$$p(t) = \sum_{n=1}^{\infty} b_n \cos \varpi_n t$$

Where

$$b_n = \frac{2 p_0}{3 n \pi} (1)^n$$

Determine the steady state response and complex frequency response coefficient of the structure due to this loading. Plot the steady state response for two full periods considering the only first three terms of the series and evaluating at time increments of $\varpi_1 \Delta t \equiv 45^0$. [17]

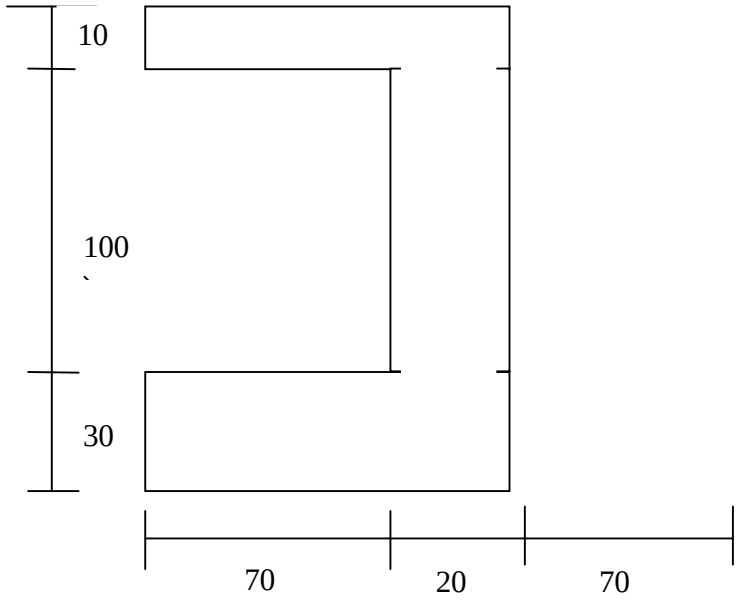

Fig 1.1

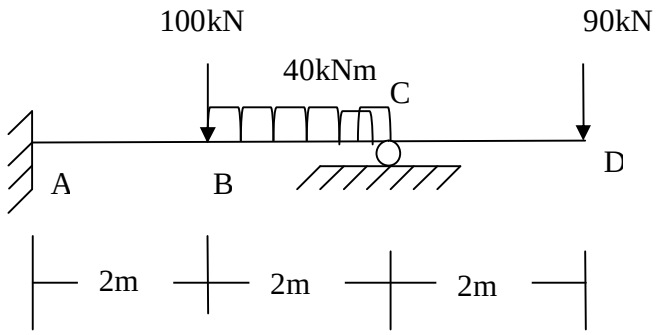

Fig 1.2

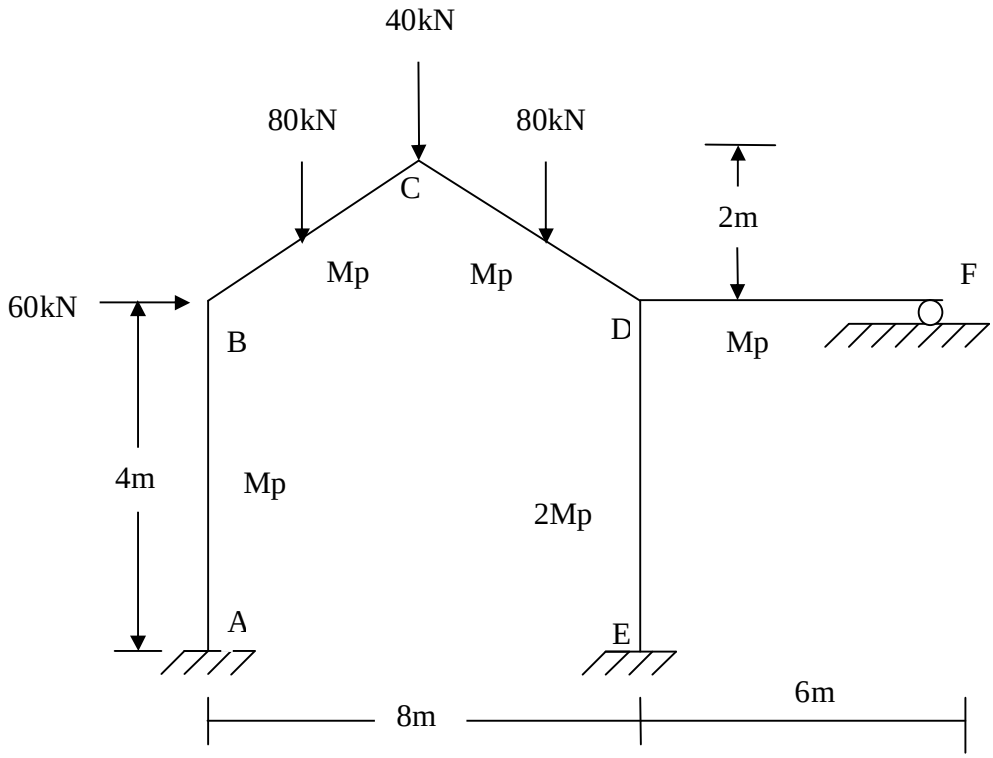
40kN
80kN
80kN
C
2m
Mp
Mp
F
60kN
B
D
Mp
4m
Mp
2Mp
A
E
6m
8m

Fig 2.1

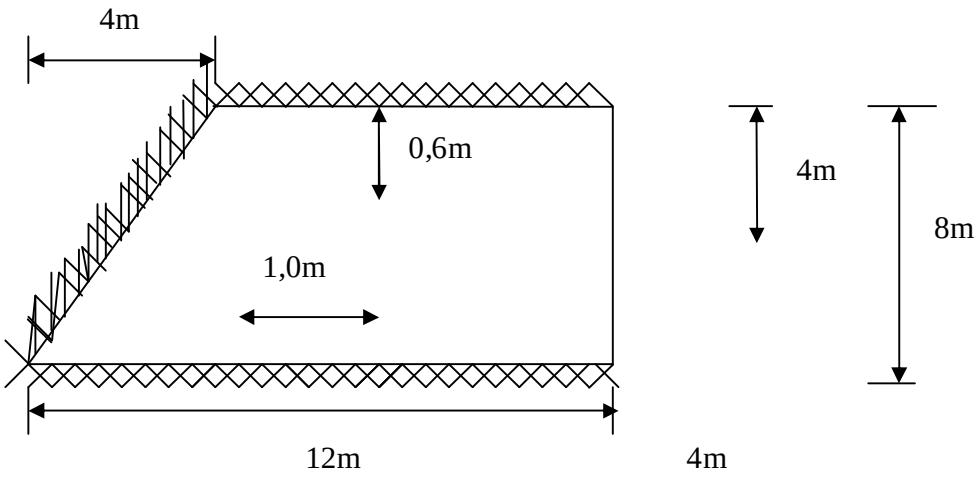
4m
0,6m
4m
8m
1,0m
12m
4m

Fig 3.1

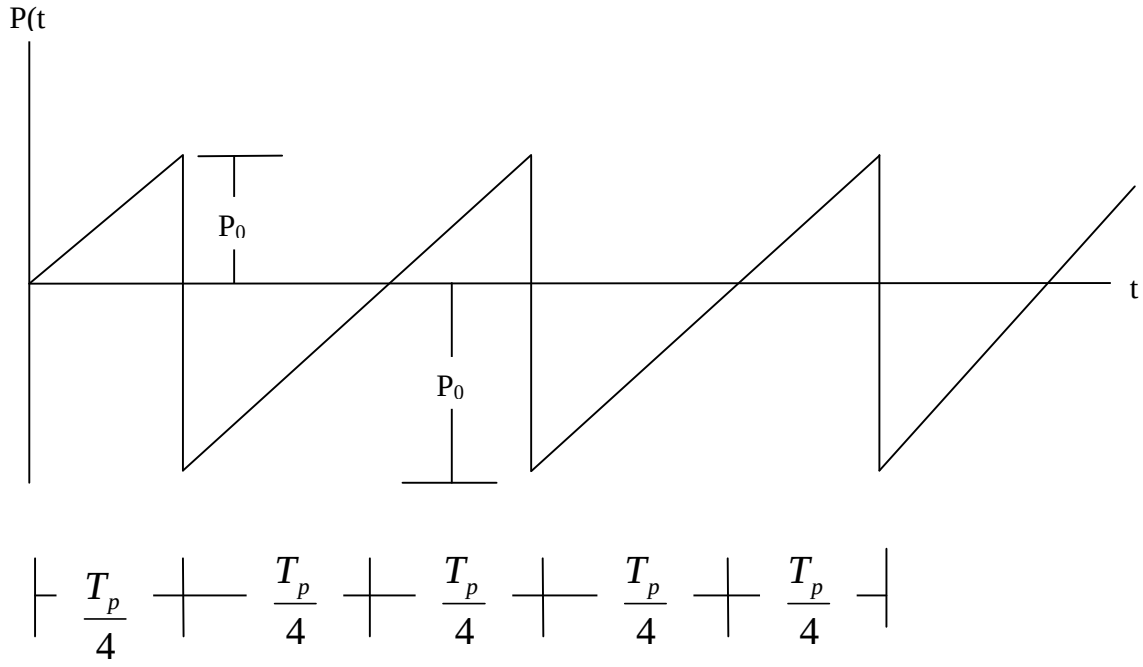

Fig 4.1