



UNIVERSITY OF GHANA  
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SCHOOL OF ENGINEERING SCIENCES

FIRST SEMESTER EXAMINATIONS: 2018/2019  
LEVEL 100: BACHELOR OF SCIENCE IN ENGINEERING

FAEN 103: BASIC MECHANICS I (3 Credits)

**INSTRUCTION:** ANSWER ALL QUESTIONS  
**TIME ALLOWED:** TWO AND HALF (2½) HOURS

1. For equilibrium of a rigid body, the following conditions must be satisfied:

$$\mathbf{F}_R = \sum \mathbf{F} = 0$$
$$\mathbf{M}_R = \sum \mathbf{M}_O = \sum (\mathbf{r} \times \mathbf{F}) = 0$$

- Explain each term in the above statements. (3 marks)
- Represent the above statements using scalar equations. (3 marks)
- The maximum allowable tension in cable  $AC$  is 600 N and in cable  $BC$  is 750 N (fig. 1). Determine:
  - The maximum force  $P$  that may be applied at  $C$ . (6 marks)
  - The corresponding value of  $\theta$ . (6 marks)

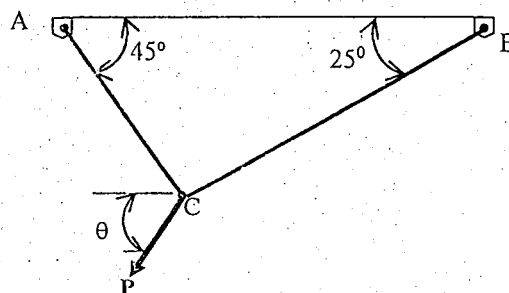


Figure 1

2. a) When are two forces equivalent? (5 marks)

b) The beam is subjected to the system of forces (fig. 2). Neglecting the reactions at the supports, reduce the given system of forces to:

- An equivalent force-couple system at  $A$ . (5 marks)
- An equivalent force-couple system at  $B$ . (5 marks)
- A single force or resultant. (7 marks)

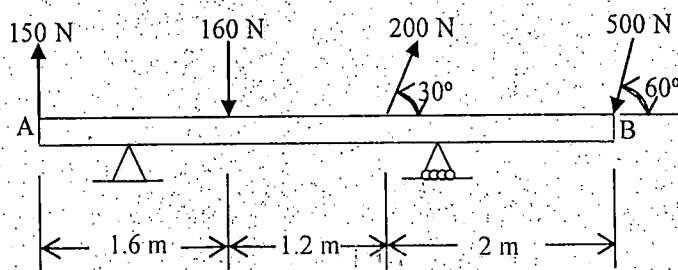


Figure 2

3.  $ABC$  (fig. 3) is acted upon by a 455 N force. The pole is held by a ball and socket joint at  $A$  and by two cables  $BD$  and  $BE$ . For  $a = 3$  m, determine the tension in each cable, and the reactions ( $A_x$ ,  $A_y$  and  $A_z$ ) at  $A$ . (30 marks)

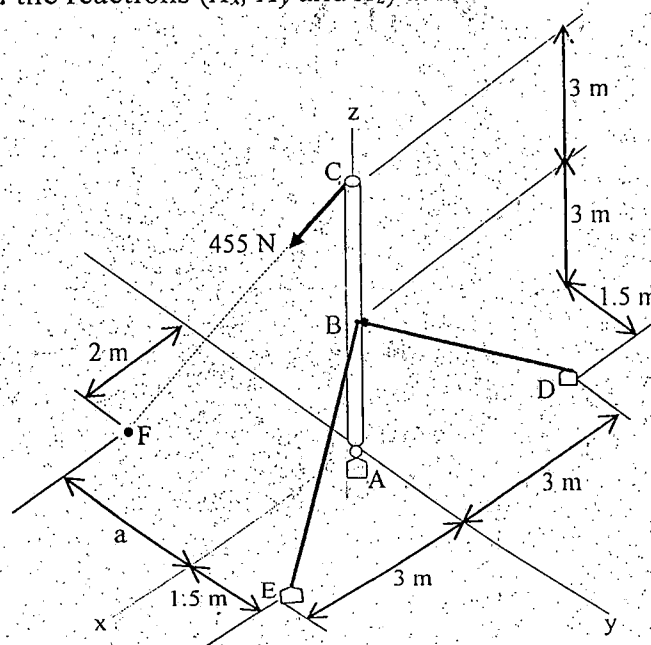


Figure 3