College of Engineering & Technology

Department: Mechanical Engineering Marks: 15
Lecturer: Dr. Rola Afify Time: 11.00 - 12.00
Course Code: ME356 Date: 4/11/2015

Name: **Model Answer** R.N.:

Answer the following questions:

Question one (6 marks)

A) Define:

i) Elasticity:

3. ***Elasticity.*** **It is the** property of a material to regain its original shape after deformation when the external forces **are removed**. This property is desirable for materials used in tools and machines. It may be **noted that steel** is more elastic than rubber.

ii) Brittleness:

6. ***Brittleness.*** It is the property of a material opposite to ductility. It is the property of breaking of a material with little permanent distortion. Brittle materials when subjected to tensile loads, snap off without giving any sensible elongation. Cast iron is a brittle material.

iii) Machinability:

9. ***Machinability.*** It is the property of a material which refers to a relative case with which a material can be cut. The machinability

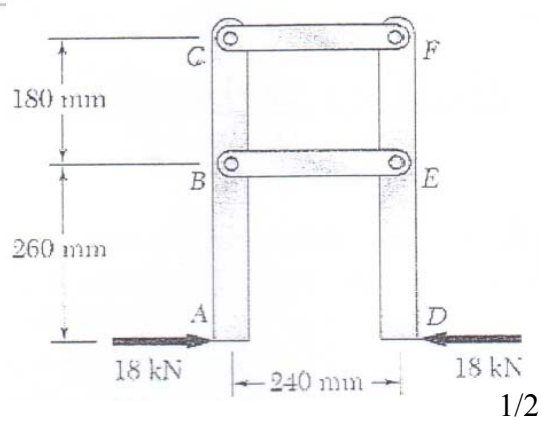
B) What are the general considerations in Machine Design?

*General considerations in machine design

1. load
2. Motion
3. Material
4. size
5. use of standard parts
6. safety
7. work shop facilities
8. Cost of Construction
9. Assembly

Question two (9 marks)

Members ABC and DEF, shown in Figure, are joined with steel links (E = 200 GPa). Each of the links is made of 25 x 25 mm plates. Determine the change in length of members BE and CF.
(Hint: $\sigma = E\varepsilon$)

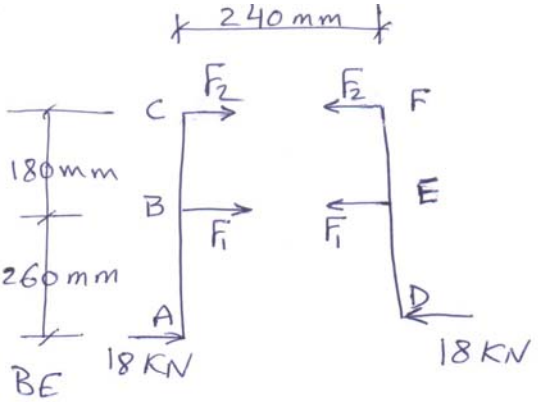


Q2

$E = 200\ GPa$

□ 25 x 25 mm plate

Δ_{BE} & Δ_{CF}



Soln Assume tension in BE & CF

$\Sigma F_x = 0 \quad \leftarrow +$

$18 + F_1 + F_2 = 0 \quad \therefore -F_2 - F_1 = 18 \longrightarrow (1)$

$\Sigma M_F = 0 \quad (+\circlearrowleft)$

$-F_1 * 180 - 18 * [260 + 180] = 0$

$\therefore F_1 = -44\ KN = F_{BE}$ Compression

sub. in (1)

$-F_2 = F_1 + 18 = -44 + 18 = -26\ KN$

$\therefore F_2 = 26\ KN = F_{CF}$ tension

$\sigma = E\ \varepsilon$

$\frac{F}{A} = E\ \frac{\Delta}{\ell} \qquad \therefore \Delta = \frac{F\ell}{AE}$

$\Delta_{BE} = \frac{-44 * 240 * 10^3}{25 * 25 * 200 * 10^3} = -0.08448\ mm$

$\Delta_{CF} = \frac{26 * 10^3 * 240}{25 * 25 * 200 * 10^3} = 0.04992\ mm$