Elective Course: Product Design

January 2011, 3rd Year at Production Engineering and Mechanical Design Department.
Please solve the next questions (3 hrs).

Question (1)
Illustrate the product lifecycle and process life cycle (on charts), demonstrating the suitable quality methods that can be used at each stage. (Use one page for each chart. Simple graphs and short phrases should be used at the right of each chart.)

Question (2)
(a) Summarize a comprehensive framework for the DFMA approach.
(b) Apply the DFMA approach to the element shown in Fig. 1 to highlight the deficiencies of the current design, and to propose an alternative design and manufacturing process.

Fig. 1. Question 2.

Fig. 2. Question 3.

Fig. 3. Question 4.

Question (3)
(a) Summarize the approach of Axiomatic Design.
(b) Fig. 2 shows a design for the diode beam adjustor of the laser marking machine; construct and comment the design matrix equation of this device, where FRs and DPs are defined as follow:

$FR_1$ : Align the vertical position of the diode laser beam.
$FR_2$ : Align the vertical angle of the diode laser beam.
$FR_3$ : Align the horizontal position of the diode laser beam.
$FR_4$ : Align the horizontal angle of the diode laser beam.

$DP_1$ : Vertically moving component.
$DP_2$ : Supporting block.
$DP_3$ : Fixing screw.

(c) Propose an alternative design for the device in (b), considering Axiom 1.

Question (4)
The process shown in Fig. 3 is a cutting process ends with a $D \times L$ bar.
(a) What are the quality problems (failures) that may accompany this bar?
(b) Use Ishikawa diagram to analyze such problems.

My best wishes

Dr. Hassan Soltan