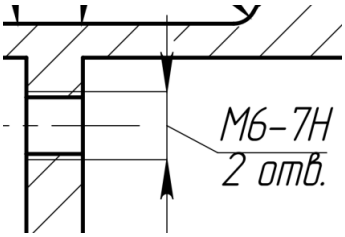
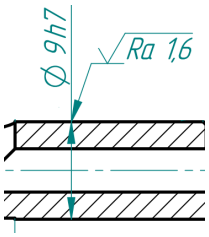
«Introduction to Mechanical Engineering»
Midterm

Task 1

1. What does it mean? You should explain each part of this notation (fig. 1).
2. Using which 4 basic operations you can design almost any solid part in CAD. Explain your choice with an example.



(a) 1st subtask



(b) 2nd subtask

Figure 1: Tasks 1.1

Task 2

1. What the difference between lower and higher kinematic pairs and. Provide examples of both types, using kinematic scheme notation.
2. Draw a kinematic scheme of the mechanism (fig. 2).

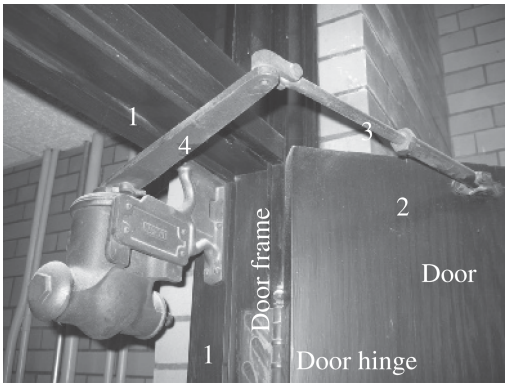


Figure 2: Task 2.2

Task 3

1. Provide at least 4 types of drives. Prof and cons.

Task 4

1. Could you name all highlighted parts from the picture (fig. 3)?
2. What the difference between bolden and direct extruders.
3. Could you write the printing process, starting that you have *ideal* CAD model in «step» format.

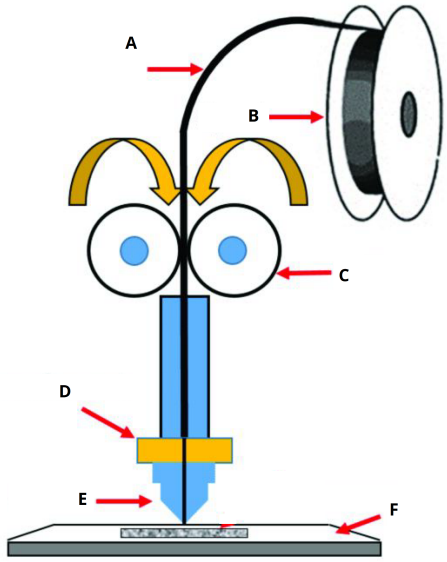


Figure 3: Task 5.1

Task 5

1. What does stress and strain mean? Stress-strain curve. What the idea besides it? Draw some curve for ductile and brittle material. How can we modify a curve behavior for some particular material?
2. Why do we need alloying elements? Could you provide at least 1 example?

Task 6

1. What types of synthesis do we have? What the main difference between them?
2. Propose the problem of structural synthesis and the steps what should you do for solving it?
3. What the difference between function generation and trajectory generation synthesis problems?

Task 7

1. You are a cleaning robot developer. You know proposed characteristics of robot inertia, and you should choose the motors for it. Robot kinematics is 2 wheel robot, with 2 supports.

   Explain your steps for choosing the motor.

Task 8

1. What the difference between rolling friction and sliding friction?