

### **Cooling of a Computer Central Processing Unit**

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Type: Design problem  
Time: Semester  
Location: Class

#### **Summary**

The objective of this project is to design a cooling system for a Pentium 66 processor. Students research different concepts of cooling and study existing models. Subsequently, they develop new design concepts, preliminary designs and final designs. This project is best carry out by a group of three or four students.

#### **ABET Descriptors**

Engrg. Sci. Content: Heat Transfer  
Type: Component  
Elements: Design specifications, evaluation, planning  
Features: Design, consider alternate solutions, open-ended  
Constraints: Economics, reliability, and efficiency  
Effort: Team

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### **Problem Statement:**

The objective of this project is to design a cooling element for the Pentium 66 processor. This is a common problem of PC systems designers. The objective of this cooling element is to ensure that the junction temperature of the processor is below 100 °C. Operation above this functional limit can degrade system performance or cause logical errors. The 66 MHz Pentium processor's maximum power dissipation is 16 W. Considering the power dissipation levels and typical ambient temperature of 40 °C to 45 °C, the Pentium processor's junction temperatures cannot be maintained below 100 °C without additional thermal enhancement to dissipate the heat generated by this level of power consumption. You need to research alternative cooling methods and design a cooling element that is going to keep the Pentium processor below its maximum working temperature

The following constraints apply:

- Intel specifies a maximum temperature of 85 °C at the center of the processor case. The case size for this processor is 2.16"x2.16".
- All the power generated should be dissipated by the cooling element attached to the case surface (This is not an Intel condition).
- The maximum air temperature inside the PC is 45 °C.
- The minimum distance between the top surface of the processor's case and the inner surface of the computer cover is 3". The height of your cooling element should not exceed this limit.
- The fan inside the computer provides an air speed of 50"/sec. As long as your design do not exceed the size of the top surface of the processor we do not expect significant changes in this speed. If needed you can suggest changes in location of components or size and location of the cooling fan.

### **Working Schedule:**

Groups of 3 students each will have individual meetings with the instructor once a week during the design period. The schedule of reports is as follows.

Week # 7: Alternative concepts and final concept selection

Week # 8: Preliminary design

Week # 9: Final design including drawings and bill of materials .

Week # 10: Instructor reviews design and meets with team.

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### Engineering Notes:

- The following document that provides guidelines in the design of cooling elements for this processor is available at the Intel world wide web server. The name of the document is *“Pentium Processor Thermal Design Guidelines”* and the Intel address is *http://www.intel.com*  
This server contains abundant information in this matter.
- Students need to have basic knowledge of extended surfaces, convective heat transfer and some basic radiation.
- While students are doing research and developing design concepts, the instructor can cover some of the important topics.
- It could be beneficial to show students an open computer and the location of the CPU. The project could be best develop using a specific computer at hand.