

# Teaching Packaging Engineering at Christian Brothers University

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## Abstract

The packaging engineering certificate program at CBU is now well established. Medical device packaging was added to the second course. This paper will describe the details of the High School Student Egg-Drop Competition (best packaging to prevent an egg breakage from the highest free fall drop), which will be held on April 7, 2005. Also, the special packaging program for high school students, which to be repeated this summer, will be discussed. New equipment was purchased for the Polymer and Packaging laboratory using the Assissi Grant. Details of these complete with pictures will be presented. Also included in this presentation are the details of Medtronic Grant received recently and negotiation phase of offering Packaging Engineering Certificate Program in Nantong, China.

## Packaging Engineering Certificate Program

Packaging Engineering Certificate program was started in fall of 2002, with course-offerings of Principles of Packaging in the fall semester, Distribution Packaging in the spring semester and Special Project. Medical device packaging was added to the second course in spring of 2003 in response to strong biomedical presence and emphasis on biotechnology in greater Memphis area.

Course enrollments are shown in Table 1 below:

Table 1. Packaging Engineering Course Enrollment

	Spring 2001 ChE 492 Special Topics in Packaging Engineering 9 students
	Spring 2002 ChE 492 Special Topics in Packaging Engineering 8 students
Fall 2002 ChE/ME 319 Principles of Packaging 4 students	Spring 2003 ChE/ME 320 Distribution/Medical Device Packaging 6 students
Fall 2003 ChE/ME 319 Principles of Packaging 3 students	Spring 2004 ChE/ME 320 Distribution/Medical Device Packaging 7 students
Fall 2004 ChE/ME 319 Principles of Packaging 10 students	Spring 2005 ChE/ME 320 Distribution/Medical Device Packaging 4 students

Two CBU chemical engineering graduates received the certificates in 2003, with Special Projects on medical packaging. Two CBU chemical engineering graduates received the certificates in 2004, with Special Projects on electrical and medical packaging. Three CBU engineering students (one electrical and two chemical) will complete the certificate in May 2005, with Special Projects on medical packaging. Two others are in line to receive the certificate by December 2005.

### Lab Equipment from the Assisi Foundation of Memphis

In May 2002, the Assisi Foundation of Memphis committed a \$3M grant to Christian Brothers University (CBU) [1]. Almost \$2M of this grant goes toward acquiring new engineering lab equipment and about \$60,000 toward the renovation of Saint Benilde Hall lab building. CBU is raising another \$400,000 to cover the cost of the renovation. The renovation project was finished in September 2003 and new equipment has been acquired since 2003 and will continue to 2005. Table 2 below shows a list of packaging-related lab equipment.

Table 2. Packaging-Related Lab Equipment from the Assisi Foundation of Memphis

Lab	Equipment	Budget	Status
Packaging	Computer	\$2000	Acquired
	Automatic Sample Table	\$120,000	Acquired
	Attitude/Pressure Chamber	\$30,000	
	Crush Tester	\$15,000	
	Mullen Burst Tester	\$15,000	
	Packaging Design Software	\$10,000	Acquired
	Shock Machine	\$60,000	
	Temperature Chamber	\$30,000	
Polymer Lab	Corrosion Tester	\$3,000	Acquired
	MDSC	\$30,000	Acquired
	Laminating Press	\$15,000	Acquired
	Plate Viscometer	\$30,000	Acquired
	Tensile Tester	\$15,000	Acquired
Manufacturing Lab	Injection Mold Machine	\$100,000	Acquired
Solid Mechanics Lab	Direct Shear Test	\$17,000	Acquired
	Impact Tester	\$10,000	
	Load Frame	\$90,000	Acquired
	3D Printer	\$37,000	Acquired
	Twist/Bend Machine	\$3,000	Acquired
	Universal Testing Machine	\$18,000	

In addition to the above lab equipment, CAPE Systems, Inc., and TOPS Engineering Corp. donated CAPE PACK and TOPS Pro/MaxLoad Pro, respectively.

## Egg-Drop Competition for High School Students

The Egg-drop competition has been the glamour event of the High School Competition (Balsa Bridge, Chemical Car, Electronic Project) held every April since 2003. This year the Egg-drop competition was held on April 7<sup>th</sup> for the third straight year with the funding from Medtronic Foundation. One hundred and ten students registered for the event. They were from twelve local high schools as well as few schools in Arkansas and Mississippi.

Barnhart Crane Co. donated the service of a man-lift to help drop eggs from 30, 45, and 66 feet. Ten packaged eggs survived the final height. First three places were then selected based on weight, volume, and design by five judges from Smith and Nephew, Medtronic, International Paper, and Christian Brothers University. First and second place winners were from Collierville High School and the third place winner was from Craigmont High School.



Figure 1. Judging Egg-Drop Contest



Figure 2. Winners of the 2005 Egg-Drop Contest

### **Packaging Summer Program**

A Summer Packaging Program for high school students was held on June 14-18, 2004. Twenty-two students from Memphis area high schools participated in this novel program. Morning sessions consisted of talks on various packaging subjects by CBU engineering professors and packaging professionals from Medtronic and FedEx. The afternoon sessions involved visiting packaging facilities of FedEx, Smith and Nephew, Shering-Plough, and Ring Container Technologies. A similar program will be offered on June 6-10, 2005, with more hands-on exercises in the morning sessions and demonstrations of new lab equipment purchased using the Assisi grant mentioned earlier. International Paper Foundation funds both program.

### **China Project**

A proposal to offer the International Packaging Technology Certificate has been submitted to Nantong Vocational College in China. Courses will be delivered to the Chinese students on their campus by the three authors during summer. Negotiation phase will be in the near future.

### **References**

1. S. Malasri, et al., "CBU Engineering Lab Facility," *Proceedings of the MAESC 2004 Conference*, May 2004.

## Appendix – Egg Drop Contest Rules

We handle packages in one form or another every day. Without packaging, our standard of living would fall far below the present level. The majority of us are not aware of the science and engineering that go into making packaging materials. Packaging engineering is a comparatively new interdisciplinary field in which scientific and engineering principles are applied to develop and produce packages that contain, protect, preserve, inform, and sell a product. The School of Engineering (CBU) is the first and only University in the Mid-South to offer a packaging engineering program designed to meet the shortage of packaging professionals in this area.

The goal of the contest is to design packaging (box and packing) to contain and protect raw chicken eggs from breaking when dropped from a height of 20 feet and more. Soft, crushable packing that encloses a lot of air is best. Foam rubber or plastics, feathers, cotton, or synthetic batting are all good “cushioners.” Think of materials that are soft and yielding and light. What soft and fluffy materials could be used? How can the weight of the package (box and packing), as well as the volume of the box, be minimized?

Each package may be tested several times at increasing heights, in order to determine first, second, and third place winners. Last year’s winning height was 60 feet. Containers must include an opening for insertion of the raw egg and checking for breakage by the event staff.

### CONTEST RULES:

1. Weight of package (without the egg) must not exceed 1 lb.
2. Maximum volume permitted is 250 cubic inches. For shapes other than circular, volume = cube of the second largest dimension.
3. No glass or other materials that shatter.
4. No sharp edges.
5. No parachutes, helium, wings, etc., are allowed to slow down the fall.
6. Contestants are to bring their packaging to the event. No materials will be provided on-site for building.
7. No commercially built packaging (injection molded, thermoformed, etc.) may be entered. Materials commonly available (plastics, Styrofoam, paper, wood, cloth, etc.) may be used in the construction of the box and packing (packaging). Discoloration of the egg due to packaging will lead to disqualification.
8. The time allowed for insertion of the egg into the packaging is limited to 60 seconds.

### JUDGING:

The competing packages will be tested with raw Grade A Large chicken eggs supplied by the CBU School of Engineering. If more than one package survives the highest drop, they will be scored as follows:

- Maximum height survived/weight of package – 65%
- Compactness (volume/weight) – 25%
- Aesthetics (how it looks) – 10%

A special prize will be awarded to the packaging judged best for its fabrication/engineering design. Judging will be independent of egg-drop results.

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