Int. J. Engng Ed. Vol. 10, No. 5, pp. 401–404, 1994
Printed in Great Britain.

0742-0269/91 $3.00+0.00
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A Study of Accredited Manufacturing Engineering Technology Programs*

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An analysis of the curricula of 23 of the 24 four-year college level programs in manufacturing engineering technology that were accredited by the Technology Accreditation Commission of the Accreditation Board for Engineering and Technology (TAC/ABET) as of Summer 1989 [1], has been carried out. The results show that, generally speaking, there is good agreement between what is being offered and the recommendations of TAC/ABET. The most notable difference is the lack of fluid mechanics and thermodynamics/heat transfer courses and the small emphasis on co-op programs.

PURPOSE

THE OVERALL purpose of this work was to determine the direction that the field of manufacturing engineering technology is taking, to find out what new developments were taking place in other school's programs and to see how Midwestern State's program compared. In addition, it was desired to compare what actually exists in the world of university manufacturing engineering technology programs with what has been recommended by TAC/ABET [2].

PROCEDURE

The first step was to break the university programs into broad subject-related areas. Three were chosen: non-technical courses, technical courses—non-engineering technology, and technical courses—engineering technology. Each of the first two areas were further separated into categories that were common to several of the programs. The decision as to how to break down the division of courses in the area 'technical courses—engineering technology' was more difficult. One example of this was the 'manufacturing processes' category. All the programs teach various manufacturing processes. However, some have separate courses for several individual processes while some place the coverage of the various processes into a general course called 'manufacturing processes'. It was found that the most common individual courses in this category were courses in machining, welding, casting and forming. Thus, these were set up as separate categories. If a program offered a course entitled 'manufacturing processes' with three semester hours of credit and that particular course description mentioned only welding and casting, then the course was listed as 1.5 h of credit under 'casting/foundry/forming'. On the other hand, if the course description mentioned several different manufacturing process methods, then 3 h of credit were listed under either 'manufacturing processes—introduction' or 'manufacturing processes—advanced', depending upon whether it was an upper or lower level course. An exception was made if the course covered only a specialty area such as plastics. In that case, the course was credited to the advanced area even though it was a lower level course.

Another area needing further explanation is technical electives. If there were only 3 h of technical electives available and a choice of only two courses from which the student could pick, the two courses were each assigned 1.5 semester hours of credit and placed in the two appropriate categories. Most of the time, however, there were so many technical electives available from which to choose that the total number of hours available for technical electives was simply placed in the area 'technical electives'.

Another example is a course described as covering fluid mechanics and power. This course's credit hours were divided in half and placed in the two categories 'fluid mechanics' and 'fluid power'. Finally, 'numerical control' was placed directly underneath its parent category, 'automation and robotics', because so many schools offered this unique subdivision of automation as one or two specifically named courses.

Examples such as those described above occurred many times in the analysis of any given program curriculum. Furthermore, in cases where a university offered more than one program in manufacturing engineering technology, such as

* Paper accepted 11 November 1993.

Table 1. Results of analysis of four-year college programs in manufacturing engineering technology

INSTRUCTIONAL AREA	TYPICAL CURRICULUM (Median)	TAC/ ABET
NON-TECHNICAL COURSES		
English	6	
Phys. Ed., Band, ROTC	1	
Speech	3	
Other non-technical	19	
Total Non-Technical Courses	27	
TECHNICAL COURSES - NON-ENGINEERING TECHNOLOGY		
Mathematics (incl. engineering mathematics)	11	****
Chemistry	4	~
Physics	8	*
Probability and statistics	2	
Computer science	3	*
Technical writing	3	
Total Technical - Non-Engineering Technology	30	
TECHNICAL COURSES - ENGINEERING TECHNOLOGY		
Orientation - technical	0	
Engineering problems	0	
Electronics/electrical	6	*
Instrumentation/process control	0	
Engineering computer applications	0	
Quality control theory, applied statistics	3	*
Quality control lab, metrology	0	
Industrial safety	0	
IE courses:Time/work,people,systems planning	9	*****
Engineering economics	2	*
Drafting, drawing, machine design	4	.5*
Computer aided drafting or design	3	.5*
Statics	3	*
Dynamics	1	
Strength of materials	3	*
Fluid mechanics	0	.5*
Fluid power	2	.5*
Materials science incl. metallurgy	4	*
Thermodynamics/heat transfer	0	*
Manufacturing processes - introduction	3	*
Manufacturing processes - advanced	0	
Machine tool processes, tool design	6	*
Welding processes	1	
Casting/foundry/forming	0	
Automation and robotics	3	*
Numerical control,CNC	3	
Capstone project	3	*
Seminar	0	
Technical electives	7	
Co-op Work/Study	0	
Total Technical Courses - Engr. Technology	76	
TOTAL SEMESTER HOURS IN PROGRAM	134	

* - recommended by TAC/ABET
**** - four different courses recommended by TAC/ABET
***** - five different courses recommended by TAC/ABET
.5* - this listing plus one other ".5*" listing comprise a course recommended by TAC/ABET
~ - listed by TAC/ABET as "desirable where appropriate"

computer integrated manufacturing (CIM) as one option and manufacturing product design as another, the option closest to the general manufacturing engineering technology program offered by most universities was used. In most cases, this would be CIM if such an option was offered. There was only one program that was very distinctly a non-general program and was a CIM program instead.

Programs whose credits were in quarter hours were converted to semester hours by multiplying the credit for each category by two-thirds. Special note was made of situations where a course was required but no hours of credit were granted for completion of the course. Horizontal dividing lines were placed in the engineering technology courses to separate the courses into somewhat related areas.

The assignment of credit among the different courses was checked for possible omissions by comparing the sum of the credits as determined by the authors with the total number of credits required for the degree as stated in the catalog. This presented a problem in some instances because some of the catalogs did not explicitly state the total required. Further study was then required to try to total the manufacturing engineering technology courses required, the general courses required by the technology division of the school and the courses required by the university core curriculum. In two cases it was not possible to determine the total semester hours required; in these cases the total number of credits assigned to various categories was not double-checked. In both cases, however, the catalog was thoroughly analyzed and the authors are confident that the total hours required are correct within approximately three semester hours.

For comparison purposes, both an average and a median were computed for each course category. The authors prefer the median because it removes some of the 'special situations' that exist at either end of the number of credit hours spectrum and it also removes the tiny numbers in the average caused by those instances where only a very few universities offer a given course. In the 'special situations' area, some of the institutes of technology have overall philosophies which are different than the typical university. Using the median tends to lessen this influence on the final 'typical curriculum'. The principal handicap of using the median is that the sum of the medians does not necessarily equal the median of the sums. This handicap shows up in the 'median' column.

The courses recommended by TAC/ABET in the 'technical' areas are marked in the TAC/ABET column by an asterisk. TAC/ABET does not specify the number of credit hours in a course area; thus this technique was used to simply indicate that the area was a recommended area. If TAC/ABET designated an area as 'desirable where appropriate', then a tilde was used. If four asterisks appear in an area, it means that four different courses were recommended. If a course recommended by TAC/ABET was divided into two different areas in the analysis table, then '.5*' was placed in each area.

RESULTS

Information presented in Table 1 indicates that there is good agreement overall between the courses being offered and the recommendations of TAC/ABET. The two exceptions are fluid mechanics and thermodynamics/heat transfer. Perhaps the lack of courses in these subjects is because they are covered to some degree in physics but, more probably, it is because the schools feel that the subjects are not vital to the manufacturing field. The authors admit to being biased towards thermodynamics/heat transfer because there are two large local manufacturers of heat transfer equipment in the Wichita Falls area.

Other unexpected results were that there is no university in the list that offers credit for co-op work/study and that there are only two that actually required co-op work/study. Cooperative education programs receive a lot of publicity. There is even a Cooperative Education Division of the American Society for Engineering Education and cooperative education programs are 'encouraged' (but not required) by TAC/ABET. Publicity aside, however, it seems that cooperative education is much more a secondary consideration than a primary one in the field of manufacturing engineering technology.

CONCLUSION

There are many variations in the TAC/ABET accredited curricula on a university-to-university basis. The median, however, agrees quite well with the TAC/ABET recommendations. TAC/ABET has very firm guidelines in many areas, such as total number of technology semester hours required (basic science and mathematics excluded). The commission does allow for diversity in curricula to meet local manufacturing needs, however.

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