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A comparison of four-year undergraduate mechanical engineering curricula

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Thesis

A COMPARISON OF FOUR-YEAR UNDERGRADUATE MECHANICAL ENGINEERING CURRICULA

Submitted by

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CHAPTER I

INTRODUCTION

The Purpose of This Study

The purpose of this study was to analyze the four-year undergraduate mechanical-engineering curricula in the engineering schools in New England and New York State, with a view to discovering clues to possible improvement of a similar curriculum in Bradford Durfee Technical Institute in Fall River, Massachusetts.

The Need for This Study

An analysis of the engineering literature shows that the most recent study[1] was made in 1939. It was financed by a grant of $10,000 from the Carnegie Foundation for the Advancement of Teaching. It covered a period from the fall of 1935 through October, 1938. Its statistics came from a study of 679 engineering curricula in 136 institutions, that were submitted for accrediting, to the Engineers' Council for Professional Development.

1/ Dugald C. Jackson, Committee on Engineering Schools, Present Status and Trends of Engineering Education in the United States, Engineers' Council for Professional Development, New York, N. Y., 1939. vi/177pp.

The results of the most important previous study were published in 1930 and 1934.[1]

Method of Analysis

Data for this study were obtained by an analysis of the latest catalogues (as of October, 1951) of the engineering schools in this survey. The list of engineering schools was obtained from the Education Directory.[2]

The mechanical engineering curricula for each school are listed on pages 47-79 of the Appendix. The credits were listed for each course. All schools except the Massachusetts Institute of Technology and Cooper Union, listed the credits for each course. The latter two listed the weekly hours of recitation, lecture or laboratory and the average weekly hours of study required for each course. A telephone conversation with the Massachusetts Institute of Technology Registrar's Office produced the formula for converting the above hours into credits. The weekly hours as listed in the catalogue for each course could be converted into credits by multiplying the class or lecture hours per week by one and adding it to the product of one

1/Society for the Promotion of Engineering Education, Report of the Investigation of Engineering Education, 1923-1929, Lancaster Press Inc., Lancaster, Pennsylvania, 1930, Volume I, lvi - 1040pp. Volume II (1934) lvii through lxvii - 1320 and xvi - 283pp.

2/Office of Education, Federal Security Agency, Education Directory, Part 3, Higher Education, 1950-51, United States Government Printing Office, Washington, D.C. 1950. 189pp.

half times the laboratory hours per week. The Cooper Union catalogue stated that this same formula could be used to convert the weekly hours to credits.

This study showed a total of 164 courses in the undergraduate mechanical-engineering curricula in the selected schools. It was decided to group the courses into the following categories for easier analysis; applied engineering, applied science, business and social studies, drafting, English, mathematics, military science, physical education, psychology, pure science, and shop. The courses in these groupings were alphabetically listed horizontally on a large sheet of paper. The schools were alphabetically listed vertically. Then the credits that each school required in each subject were listed on this work sheet in the appropriate columns.

The analyses and tables were compiled from this work sheet.

Review of Related Studies

A study of the engineering education literature shows that much thought has been given to plans for improving the engineering curricula, as indicated by the following excerpts.

> "Engineering curricula should be simplified, reduced in total requirements, and devoted more to fundamentals and less to applications. Students should not spend less time on their work, but should concentrate on smaller coverage of ground with consequent improvement in mastery of fundamental principles.

A good deal of lip service is given to 'teaching of fundamentals' but, as a matter of fact, this is not carried out in practice. Curricula are not only overburdened with courses of study but the individual courses cover so much ground that even the best students can not master them.

In my opinion, a decrease of 15 to 20 percent in ground to be covered with a corresponding increase in thoroughness would raise the general effectiveness of engineering education to a very great degree."1/

Another recent study of engineering education states:

"Many perplexing problems stem from the fact that the engineering college, in preparing students for professional work that will reach maximum culmination twenty or more years hence, must evaluate hazely discernable future events. It certainly appears desirable that a major stress be placed upon those elements of the curriculum that will give the most continuous and lasting support to the graduate's life. Apart from the teaching of the professional attitude toward engineering and the instilling of the engineering and scientific method of attack upon problems, there are certain specific features of the curriculum that can be accepted as most essential.

The first of these has to do with courses least likely to obsolesce. While it is necessary to give a certain amount of instruction relating to the present state of the art, it is certain that the present state will change, and hence that time given to such courses is not time devoted to a subject of sustaining value. Sifting back through the curriculum, it seems clear that instruction in the basic sciences, if taught in a manner such that knowledge of them makes available working tools, contributes the most sustaining part of the curriculum.

....Building into the program in this and other means for technical self-improvement of the individual after graduation is the second most important feature of a well designed curriculum.

1/H.P. Hammond, "How Can the Effectiveness of Engineering Education be Improved," Mechanical Engineering (September 1949) 71:739

> The third feature that impresses your committee as of ranking importance has to do with the way in which the applied courses are related to those in basic and applied science. Two distinct approaches are discernable in present practice: one utilizes the engineering situations provided in the applied courses to illustrate the manner of employing the sciences in engineering work, while the other makes the applied courses the goal of the curriculum with the minimum of application of the sciences. The former builds into the student a power of analysis and resolution in engineering situations that permits a wide range of application. The latter tends toward the achievement of a series of skills intended to equip the student for specific jobs immediately upon, and soon after, graduation. The first is professional preparation, the second vocational training. What is involved is not alone the way in which individual courses are presented; it especially relates to the prevailing concept of the whole curriculum." 1/

It should be pointed out that the Engineers' Council for Professional Development does not require a rigid, undeviating, standard curriculum before it will accredit it. The following is a part of the basic policies:

> "The avoidance of rigid standards as a basis for accrediting, in order to prevent standardization and ossification of engineering education and to encourage well planned experimentation.
>
> As a safeguard to the public and without setting any rigid standards, the nonaccrediting of curricula which omit a significant portion of a subject in which the public may reasonably expect engineers of that field to have competence.
>
> The careful consideration of qualitative as well as quantitative factors through a visit of inspection by

1/S.C. Hollister, C.S. Crouse, L.F. Grant, M.D. Hoven, Report of Committee on Adequacy and Standards of Engineering Education, Engineers' Council for Professional Development, Nineteenth Annual Report, September 30, 1951, New York, N.Y. p. 19.

a competent committee of engineers and engineering educators." 1/

The Committee on Undergraduate Curricula stated:

> "In the undergraduate program there should be a substantially equal division of time in the four following groups [which make up the whole curricula] general education, mathematics and natural science, basic engineering sciences, and specific technological applications." 2/

The dean of humanities at the Massachusetts Institute of Technology stated:

> "The actual allocations to the "humanities" and the social sciences is at most one sixth of the total time allowed for class room and preparatory exercises in the four undergraduate years. Thereafter the studies in these fields disappear.
>
> ....The young man pursuing science or engineering in many liberal arts institutions can in fact escape with a bachelor's degree based on a far smaller dosage than this." 3/

1/Op. cit., p. 28

2/Committee on Undergraduate Curricula, American Society for Engineering Education, "Principles Which Should Guide the Development of an Undergraduate Program in Engineering," Journal of Engineering Education, (September, 1949), 40:54

3/John Ely Burchard, "The Humanities and the Social Sciences in a Technological Education, "The Journal of Higher Education, (April, 1948), 2:174

List of Schools

The following list includes all the schools that offer a four-year undergraduate mechanical engineering curriculum in New England and New York State.

Connecticut

University of Bridgeport
University of Connecticut
Yale University

Maine

University of Maine

Massachusetts

Bradford Durfee Technical Institute
Massachusetts Institute of Technology
Tufts College
University of Massachusetts
Worcester Polytechnic Institute

New Hampshire

University of New Hampshire

New York

City College of New York
Clarkson College of Technology
Columbia University
Cooper Union
New York University
Polytechnic Institute of Brooklyn
Pratt Institute
Rensselaer Polytechnic Institute
University of Buffalo
University of Rochester

Rhode Island

Brown University
University of Rhode Island

Vermont

Norwich University
University of Vermont

The undergraduate mechanical engineering curriculum at Cornell University is not included in the previous list because it is a five year course. The curriculum at Northeastern University is not included because it is a five-year cooperative course. The curricula at Harvard University and Dartmouth College are not included because they do not culminate in a bachelor's degree in the field of mechanical engineering. In the latter two institutions, a student in five years, would receive an A.B. degree with a liberal arts major and an M.S. degree in mechanical engineering.

CHAPTER II

TABLES AND THEIR INTERPRETATION

Accreditation of Schools

This chapter presents a statistical picture of the courses in the four-year undergraduate mechanical engineering curriculum. This is given in the form of tables with interpretations.

Table 1 shows whether or not the school or curriculum is accredited by the various accrediting agencies.

Table 1. Accreditation of Colleges and Curricula.

Colleges	A	B	C	D
(1)	(2)	(3)	(4)	(5)
Bradford Durfee Technical Institute....	-	-	-	x
Brown University.....	x	-	x	x
City College of New York.....	-	x	x	x
Clarkson College.....	-	x	x	x

(concluded on next page)

Symbols used are as follows:

A. College accredited by the New England Association of Colleges and Secondary Schools.
B. College accredited by the Middle Atlantic States Association of Colleges and Secondary Schools.
C. Mechanical engineering curricula accredited by the Engineers' Council for Professional Development.
D. College accredited by State Department of Education.

Table 1. (concluded)

Colleges (1)	A (2)	B (3)	C (4)	D (5)
Columbia University	-	x	x	x
Cooper Union	-	x	x	x
Massachusetts Institute of Technology	x	-	x	-
New York University	-	x	x	x
Norwich University	x	-	x	x
Polytechnic Institute of Brooklyn	-	x	x	x
Pratt Institute	-	x	x	x
Rensselaer Polytechnic Institute	-	x	x	x
Tufts College	x	-	x	-
University of Bridgeport	-	-	-	x
University of Buffalo	-	x	-	x
University of Connecticut	x	-	x	x
University of Maine	x	-	x	-
University of Massachusetts	x	-	x	-
University of New Hampshire	x	-	x	-
University of Rhode Island	x	-	x	x
University of Rochester	-	x	x	x
University of Vermont	x	-	x	x
Worcester Polytechnic Institute	x	-	x	-
Yale University	x	-	x	x

In reference to Table 1, it should be stated that the regional accrediting agency for colleges in the New England States is the New England Association of Colleges and Secondary schools, while for New York State, the regional accrediting agency for colleges is the Middle Atlantic States association of Colleges and Secondary Schools. Thus a college can not be checked in both columns 2 and 3 of Table 1.

All the twenty-four schools in this study, except two, the Bradford Durfee Technical Institute and the University of Bridgeport, were accredited by their regional accrediting agency.

Column number 4 in Table 1 indicates if the undergraduate mechanical engineering curricula has been accredited by the Engineers' Council for Professional Development. This organization does not accredit the whole school, it only accredits individual, major, undergraduate, engineering curricula.

Only three of the undergraduate mechanical engineering curricula studied were not accredited by the Engineers' Council for Professional Development. The three curricula not accredited were those at the Bradford Durfee Technical Institute, the University of Bridgeport and the University of Buffalo.

Column 5 of Table 1 indicates the colleges that are accredited by the departments of education of the various states. The New Hampshire State Board of Education does not approve or accredit four-year post-secondary institutions.

The University of Bridgeport and the Bradford Durfee Technical Institute are only accredited by one agency, their respective state department of education.

All the colleges in this study were accredited by at least one organization. The maximum number of agencies that it was possible to be accredited by in this study was three; the regional association, the Engineers' Council for Professional Development and the state board of education (except in the case of New Hampshire). There are other

organizations that accredit colleges or curricula but they are not applicable in the case of the undergraduate mechanical engineering curricula.

Table 2 shows the total number of credits required for graduation and the number of credits required during the summer session for the schools in this study.

Table 2. Credits Required for Graduation and Credits Required During the Summer Session.

Colleges	Credits for graduation	Credits required during summer session
(1)	(2)	(3)
Massachusetts Institute of Technology...	173.5	-
Clarkson College.....	157	8
University of Maine.....	156	-
University of Massachusetts.....	154	6
University of Vermont.....	152	-
Norwich University.....	150	-
Worcester Polytechnic Institute.....	148	4.5a/
Rensselaer Polytechnic Institute.....	147	-
University of Rhode Island.....	147	-
Bradford Durfee Technical Institute.....	145	-
Cooper Union.....	144	2
Polytechnic Institute of Brooklyn.....	144	-
Tufts College.....	144	-
University of Bridgeport.....	144	14
University of New Hampshire.....	144	-
University of Rochester.....	144	-
Columbia University.....	143	5
New York University.....	143	-
Pratt Institute.....	143	a/
University of Connecticut.....	142	-
City College of New York.....	140	?
University of Buffalo.....	140	-
Yale University.....	132	-
Brown University.....	128	-
Mean	146	

a/Summer reading required.

The credits required for graduation which are shown in column 2 of Table 2, indicate a wide variation in the number of credits required for graduation. Brown University required 128 credits which was the lowest of the schools studied. The Massachusetts Institute of Technology required 173.5 credits for graduation. This was the highest total for the schools in this study. The mean total credits required for graduation was 146 credits. On a percentage basis the Massachusetts Institute of Technology required 35.5 per cent more credits than Brown University. The difference in the total number of credits required for graduation, 45.5 credits, is equivalent to the number of credits in a normal school year.

From the mean number of credits required for graduation, 146, it was calculated that the average number of credits required per year was 36.5 and that the number of credits required per term was 18.25.

Some of the schools in this study required attendance at a summer session, as shown in column 3 of Table 2. The policy of the University of Bridgeport concerning summer sessions was stated in their catalogue as follows:
"Very well qualified students may request permission to eliminate the summer session by carrying heavier programs of studies."[1/]

1/ University of Bridgeport, Catalogue 1950-1951, Bridgeport, p.95.

The summer session policy of the City College of New York was stated as follows: "All engineering students must attend summer session, during the summer next following the upper sophomore year, to complete some of the required courses listed in the third or fourth year, to be selected by the faculty."[1/]

Column 3 of Table 2 shows that there is a difference of opinion in the need for a required summer session in the undergraduate mechanical engineering curricula. Six schools require attendance at a summer session. Another school excuses "well qualified students" from the summer session if they complete the summer session courses during the regular school year.

If seventeen out of the twenty-four or 70.8 per cent of the schools do not require a summer session, there is no reason for the rest of them to require a summer session.

Tables 3 through Table 15 give a statistical picture of the four-year undergraduate mechanical engineering curricula in the engineering schools in New England and New York State. For statistical purposes it was decided to divide the subjects in the curriculum into the following groups; applied engineering, applied science, business and social studies, drafting, electives, English, mathematics,

1/City College of New York, Bulletin 1951-1952, New York, p.31.

military science, physical education, psychology, pure science, and shop.

It should be stated that in this study no account is taken of the depth of instruction in each subject.

Frequency Distribution of Courses

Tables 3 through 10 give the frequency distribution of the courses in the various groupings.

Table 3. Frequency Distribution of Courses in Applied Engineering in Twenty-Four Selected Colleges.

Course	Frequency
(1)	(2)
Air conditioning and refrigeration	2
Air conditioning, heating and ventilation	5
Air conditioning, heating and ventilation and refrigeration	1
Combustion engines and turbines	1
Community surveys	1
Conferences (engineering)	1
Electrical circuits	1
Electrical controls	1
Electrical engineering	21
Electrical engineering laboratory	8
Electrical machinery	5
Electronics, applied	1
Electronics, engineering	1
Engineering problems	3
Heat power	5
Hydraulic machines	1
Indication and control	1
Industrial engineering	3
Inspection methods	1
Inspection trips	1
Internal combustion engines	14
Machine design	22
Machine processes	1
Manufacturing engineering	1
Manufacturing processes	6

(concluded on next page)

Table 3. Concluded

Course	Frequency
(1)	(2)
Manufacturing tools and methods	1
Materials testing laboratory	14
Mechanical engineering laboratory	19
Mechanical instrumentation	2
Mechanical measurements	1
Mechanical processes	2
Mechanical technology	1
Metallurgical design	1
Metal processing	1
Power Plants	16
Production design	1
Refrigeration	2
Seminar in mechanical engineering	6
Structures	6
Surveying	6
Survey of scientific literature	1
Textile machinery operation	1
Thesis	1
Tool and jig design	1
Turbines	1

Table 3 shows that 22 of the 24 colleges required a course in machine design. One of the colleges that did not offer this course gave one in metallurgical design which is somewhat comparable in content to a course in machine design. The other college that did not offer this course did not offer any comparable course.

Twenty-one of the colleges required a course in electrical engineering. The other three required a different course in electrical engineering, namely, electrical machinery. One of the three also required a course in

electrical circuits. Thus all the colleges studied required at least one course in the field of electrical engineering.

Nineteen colleges required a course in mechanical engineering laboratory. It is possible that the other five included this material in the laboratory work of another course. In some colleges, laboratory work, lectures and recitations are combined into one course. Some colleges make the lecture and recitation part of a subject, a separate course from the laboratory part of the same subject. The laboratory part of the subject is sometimes made a separate course. Then again the laboratory work is sometimes omitted completely. There are 43 other courses beside the three mentioned above in the applied engineering group. The number of colleges that required these courses was relatively small for each course.

The average number of subjects required by each college studied, in the applied engineering group, was eight.

Table 4. Frequency Distribution of Courses in Applied Science in Twenty-Four Selected Colleges.

Course	Frequency
(1)	(2)
Applied mechanics	3
Dynamics	15
Dynamics of liquids	2
Dynamics and vibrations	1

(concluded on next page)

Table 4. Concluded

Course	Frequency
(1)	(2)
Electricity and magnetism	1
Engineering fluid acceleration and Displacement	1
Engineering materials	6
Engineering materials and manufacturing	1
Engineering materials and processes	1
Fluid mechanics	21
Fluid mechanics laboratory	4
Fuels and engineering chemistry	1
Graphics and statics	1
Heat transfer	9
Kinematics	10
Materials of construction	1
Mechanical vibrations	1
Mechanics	10
Mechanics of machines	5
Mechanics of materials	8
Mechanism	6
Metallurgy	13
Metals and alloys	1
Statics	13
Statics and dynamics	1
Statics and kinematics	1
Strength of materials	15
Thermodynamics	24
Vibrations and lubrication	1

Table 4 shows that all the colleges in this study required a course in thermodynamics.

Twenty-one colleges required a course in fluid mechanics. Of the remainder, one required a course in dynamics of liquids which is somewhat comparable to a course in fluid mechanics. The remaining two colleges did not require any course in fluid mechanics or any course comparable to it.

Although only ten colleges required a course in mechanics, the remainder required courses covering the same material. The names of these other courses were applied mechanics, dynamics, statics, dynamics and vibrations, and mechanics of materials.

Fifteen of the colleges required a course in strength of materials. Three of the remainder required a course in engineering materials, which is similar to the course in strength of materials. The remaining six did not require any course covering this subject matter.

Thirteen colleges required a course in metallurgy and one required a course in metals and alloys which could be similar to a course in metallurgy.

The number of colleges that required the remaining courses is relatively small for each course.

The average number of subjects required by each college studied, in the applied science group was 7.4.

Table 5 shows the number of times that courses in business and social studies were required by each of the colleges in this study.

Table 5. Frequency Distribution of Courses in Business and Social Studies.

Course	Frequency
(1)	(2)
American government	1
Business law	1
Business organization and mangement	1
Civilization	1
Civilization, contemporary	1
Civilization, modern	1
Contracts	1
Economic and social principles	1
Economic history of the United States	1
Economic institutions	1
Economics	13
Engineering economics	3
Engineering economy	4
Engineering lectures	2
Engineering library technique	1
Engineering survey	2
Historical background of the modern world	1
History	1
History of western civilization	1
Humanities	6
Industrial administration	1
Industrial economics	1
Industrial leadership	1
Industrial management	3
Industrial management and safety engineering	1
Industrial marketing	1
Industrial organization	2
Introduction to science and engineering	1
Orientation	6
Orientation to textiles	1
Political institutions	1
Social institutions	1
Social studies	2
Time and motion study	1

Table 5 shows that thirteen of the colleges required a course in economics, four others required a course in engineering economics or engineering economy which could be

similar in content to a course in economics but possibly emphasizing economics from an engineering standpoint. Five of the remainder colleges required a course related to economics or business such as business law, business organization and management, eponomics and social principles, or industrial management. The remaining two colleges did not require any courses in economics, business or management.

It is interesting to note that six of the colleges required a course in humanities. Some of the other courses in this group are humanity courses. Humanity courses can also be taken as electives which are discussed later. On the subject of humanities, the committee on engineering education after the war stated that;

> "Adequate time must be allocated to the humanistic-social studies. A designed sequence of courses should extend throughout the four undergraduate years and require a minimum of approximately 20 per cent of the student's educational time. This allotment should be at least equivalent to one three hour course extending throughout the curriculum, and on the average somewhat more." 1/

The remaining courses in this group were only required by a very few colleges.

1/Society for the Promotion of Engineering Education, "Report of the Committee on Engineering Education After the War," Journal of Engineering Education (May 1944) 34:593-594.

Table 6. Frequency Distribution of Courses in Drafting in Twenty-Four Selected Colleges.

Course	Frequency
(1)	(2)
Descriptive geometry	17
Descriptive geometry and drafting	5
Engineering drafting	17
Machine drawing	8
Mechanical drawing	4
Technical sketching	1

Table 6 shows that 22 of the colleges required a course in descriptive geometry and an analysis of the remaining two colleges' course in drafting showed that descriptive geometry was covered in the drafting course. All the colleges required at least one course in drafting.

The average number of subjects required in this group, by the twenty-four selected colleges, was 2.2.

In the matter of electives, all the colleges in this study required them. Only two of the colleges allowed their students a free choice of electives, that is they could choose either technical electives or non technical electives. Sixteen of the colleges required their students to take non technical electives. It should be stated some of the colleges allowed the student to take any non technical course that the college offered. Other colleges required that the students select the non technical course from certain selected fields, others allowed the students to

choose from only a few selected courses.

At the Massachusetts Institute of Technology, the non-technical electives were planned to make an integrated program of humanities.

Seventeen colleges required courses in technical electives. Some limited the choice to a few specific courses. The others required that the department head approve the choice of technical electives.

Table 7. Frequency Distribution of Courses in English in Twenty-Four Selected Colleges.

Course	Frequency
(1)	(2)
English	19
English composition	9
English and American literature	1
English literature	4
Modern literature	1
Public speaking	12
Technical speeches and reports	2
Technical writing	5

All the selected colleges required courses in English. The average number of subjects required in this group was 2.2. Although Table 7 does not show this information, it is interesting to note that courses in English, and English composition were given in the first year or in the first and second years. One college was an exception to this rule, it required English in the first and second years

and English composition in the third year.

Colleges that required public speaking offered it in either the first or second year.

Table 8. Frequency Distribution of Courses in Mathematics in Twenty-Four Selected Colleges.

Course	Frequency
(1)	(2)
Algebra	5
Algebra and plane geometry	2
Algebra and trigonometry	4
Algebra, trigonometry and analytic geometry	1
Algebra and calculus	1
Analytic geometry and calculus	10
Analytic geometry	5
Analytic geometry and spherical trigonometry	1
Applied mathematics	1
Calculus	18
Calculus, differential	4
Calculus, integral	4
Calculus and differential equations	1
Differential equations	15
Engineering mathematics	2
Trigonometry	4
Trigonometry and analytic geometry	1
Trigonometry, analytic geometry and calculus	1

All the colleges studied required courses in calculus. Sixteen of them also required a course in differential equations.

Five colleges required a course in analytical geometry and fourteen others stipulated it in combination with another mathematical subject. Some colleges include the fundamentals of analytic geometry in the course in calculus.

The twenty-four colleges all stipulated algebra and plane geometry as part of the entrance requirements. But five of the colleges required the freshmen to take a course in algebra. Seven other colleges required their freshmen to take a course in mathematics which also included instruction in algebra. Six colleges stipulated that the freshmen take a mathematical course which included instruction in trigonometry. These latter colleges listed trigonometry as an entrance requirement.

In other words, thirteen colleges made their freshmen take courses in either algebra or trigonometry or both. These colleges listed this material as an entrance requirement. The other eleven colleges did not require their students to again receive instruction in algebra and trigonometry.

All the colleges in this study required algebra as an entrance requirement. Thirteen of the colleges required the freshmen to receive instruction again in algebra. Eleven did not require this. It is suggested that algebra instruction in the four-year undergraduate mechanical engineering curricula be eliminated. It is also suggested that those colleges that require trigonometry as an entrance requirement eliminate instruction in trigonometry. Worth while courses can easily be found to replace those that were eliminated.

The military science group of courses shows that eleven colleges require instruction in this subject. This instruction is required in colleges that benefit from the Land Grant Act of Congress.

In the physical education group of courses, eighteen colleges required courses in physical education. The six other colleges did not require any courses in this group.

Two colleges required courses in the psychology group. One college required two courses, one in psychology and one in industrial psychology. The other college required one course in applied psychology.

Table 9. Frequency Distribution of Courses in Pure Science.

Course	Frequency
(1)	(2)
Chemistry	24
Physical chemistry	1
Atomic physics	1
Modern physics for engineers	1
Physics	24

Table 9 shows the greatest consistency of all the tables in the study. All the colleges required courses in physics and chemistry. One college required a course in physical chemistry, another required a course in atomic physics, and another required a course in modern physics for engineers.

Table 10. Frequency Distribution of Courses in Shop Practice

Course	Frequency
(1)	(2)
Foundry lectures	1
Gage laboratory and pattern work	1
Machine tool laboratory	6
Mechanical instrument laboratory	1
Metal casting laboratory	4
Pattern making and welding	1
Precision gage laboratory	1
Shop practice	7
Shop production methods	1

The average number of subjects required in this group by the twenty-four selected colleges was 0.92. Nine colleges did not require any shop courses. Six colleges required a course in machine tool laboratory and seven others required a shop practice course. These two courses are somewhat similar. Four colleges required a course in metal casting laboratory.

The remaining courses only appeared once amount the various twenty-four selected colleges.

Percentage Distribution of Courses

Tables 11 through 15 give a statistical picture of the percentage distribution of credits in the twenty-four selected colleges in the different groupings.

Table 11. Percentage Distribution of Credits in Applied Engineering, Applied Science, and Pure Science in Twenty-Four Selected Colleges.

College	Applied Engineering	Applied Science	Pure Science
(1)	(2)	(3)	(4)
Bradford Durfee Technical Institute	19.3	17.9	12.4
Brown University	3.1	28.1	18.7
City College of New York	29.3	17.1	12.1
Clarkson College of Technology	13.4	24.8	15.3
Columbia University	23.8	21.7	11.9
Cooper Union	22.6	18.8	19.1
Massachusetts Institute of Technology	20.8	17.3	17.3
New York University	17.5	19.6	12.6
Norwich University	22.7	18.0	14.7
Polytechnic Institute of Brooklyn	22.9	16.7	15.3
Pratt Institute	23.8	20.3	16.8
Rensselaer Polytechnic Institute	15.0	21.1	16.3
Tufts College	22.2	19.4	13.9
University of Bridgeport	25.7	22.2	13.9
University of Buffalo	21.4	19.3	12.9
University of Connecticut	24.0	19.0	11.3
University of Maine	25.3	16.0	11.5
University of Massachusetts	20.8	20.8	9.1
University of New Hampshire	24.3	17.4	13.9
University of Rhode Island	17.7	21.1	12.3
University of Rochester	17.4	20.8	11.1
University of Vermont	23.0	16.5	13.2
Worcester Polytechnic Institute	20.3	17.2	13.5
Yale University	24.2	18.2	15.2
Mean	20.8	19.5	13.9

Table 11 shows that the mean percentage of credits required in applied engineering for the twenty-four selected colleges was 20.8 per cent. Except for Brown University the range was from 15.0 per cent to 29.3 per cent. Brown was far below the mean with only 3.1 per cent.

The average percentage of credits in applied science was 19.5 per cent, with a minimum of 16.7 per cent and a maximum of 28.1 per cent. Excluding Brown University which was low in applied engineering and was high in this category, the maximum would have been 24.8 per cent.

The mean percentage of credits in pure science was 13.9 per cent. The minimum was 9.1 and the maximum was 19.1. The University of Massachusetts had the lowest percentage in this group, excluding this University's figure, the lowest would have been 11.1 per cent.

The percentage of credits required by the colleges in this study, in the above groups, showed a small variation between the maximum and the minimum percentages, especially if the three exceptions noted above were omitted. The percentage of credits required by the selected colleges in the above groups clustered fairly close to the mean and did not have too wide a variation between the maximum and the minimum.

Table 12. Percentage Distribution of Credits in Business and Social Studies, Drafting and English in Twenty-Four Selected Colleges.

College	Business and Social Studies	Drafting	English
(1)	(2)	(3)	(4)
Bradford Durfee Technical Institute	10.3	2.8	9.0
Brown University	3.1	6.2	6.2
City College of New York	12.9	4.3	5.0
Clarkson College	11.5	2.6	5.1
Columbia University	17.5	4.2	1.4
Cooper Union	14.6	4.2	6.9
Massachusetts Institute of Technology	5.2	5.2	3.5
New York University	11.2	3.5	7.0
Norwich University	4.0	4.0	8.0
Polytechnic Institute of Brooklyn	13.9	4.2	11.1
Pratt Institute	12.6	2.8	9.1
Rensselaer Polytechnic Institute	6.8	3.4	6.1
Tufts College	2.1	4.2	4.2
University of Bridgeport	4.2	6.3	6.9
University of Buffalo	4.3	5.7	4.3
University of Connecticut	-	4.2	8.5
University of Maine	3.8	3.8	7.7
University of Massachusetts	-	3.9	7.8
University of New Hampshire	8.3	4.2	5.6
University of Rhode Island	2.0	4.8	8.2
University of Rochester	9.0	4.2	8.3
University of Vermont	4.0	6.1	7.9
Worcester Polytechnic Institute	2.7	6.1	5.4
Yale University	4.5	4.5	9.1
Mean	7.0	4.4	6.8

Table 12 shows that the average percentage of credits

required by the selected colleges in the business and Social studies group of courses was 7.0 per cent. There was a wide variation in this category, from zero to 17.5 per cent.

The average percentage of credits required in the drafting group was 4.4 per cent with a minimum of 2.6 and a maximum of 6.3 per cent. The dispersion in this group was relatively narrow.

The mean percentage of credits required in the English group was 6.8 per cent, with a range of 1.4 per cent to 11.1 per cent. If the lowest and the highest figures were omitted the range would have been 3.5 to 9.1 per cent, which would have shown a fairly consistent percentage requirement.

Table 13. Percentage Distribution of Credits in Free Electives. Non-Technical Electives and Technical Electives in Twenty-Four Selected Colleges.

College	Free Electives	Non Technical	Technical
(1)	(2)	(3)	(4)
Bradford Durfee Technical Institute.....	8.3	-	1.4
Brown University.....	-	12.5	9.4
City College of New York.....	-	-	-
Clarkson College.....	-	1.9	9.6
Columbia University.....	-	-	2.1
Cooper Union.....	-	2.8	-

(concluded on next page)

Table 13 Concluded.

College	Free Elect-ives	Non Tech-nical	Technical
(1)	(2)	(3)	(4)
Massachusetts Institute of Technology.....	-	5.2	10.4
New York University.....	-	-	12.6
Norwich University.....	2.0	-	4.0
Polytechnic Institute of Brooklyn.....	-	-	2.1
Pratt Institute.....	-	-	-
Rensselaer Polytechnic Institute.....	-	4.1	9.5
Tufts College.....	-	12.5	6.3
University of Bridgeport.....	-	8.3	-
University of Buffalo.....	-	10.0	4.3
University of Connecticut.....	-	19.0	-
University of Maine.....	-	11.5	-
University of Massachusetts....	-	11.7	3.9
University of New Hampshire....	-	8.3	-
University of Rhode Island.....	-	8.2	4.1
University of Rochester.....	-	8.3	6.3
University of Vermont.....	-	7.9	4.0
Worcester Polytechnic Institute	-	9.5	5.4
Yale University.....	-	-	13.6
Mean	0.4	5.9	4.5

Table 13 shows that the mean percentage of credits required in free electives was 0.4 per cent. Only two colleges allowed a free choice of electives. And this only to an extent of 2.0 and 8.3 per cent.

In the case of non-technical electives the mean was 5.9 per cent with a minimum of zero per cent and a maximum of

19.0 per cent. This is a rather wide variation.

The average percentage of credits required in the technical elective group was 4.5 per cent. The minimum was zero and the maximum was 13.6 per cent. This is a rather wide dispersion of requirements.

Table 14. Percentage Distribution of Credits in Mathematics, Military Science, and Physical Education in Twenty-Four Selected Colleges.

College	Mathematics	Military Science	Physical Education
(1)	(2)	(3)	(4)
Bradford Durfee Technical Institute	11.0	-	-
Brown University	9.4	-	0
City College of New York	9.3	-	2.9
Clarkson College	10.8	5.1	-
Columbia University	8.4	-	4.2
Cooper Union	11.1	-	1.4
Massachusetts Institute of Technology	6.9	5.8	1.2
New York University	10.5	5.6	-
Norwich University	10.7	10.7	-
Polytechnic Institute of Brooklyn	13.9	-	0
Pratt Institute	13.3	0	-
Rensselaer Polytechnic Institute	9.5	-	2.7
Tufts College	11.1	-	2.1
University of Bridgeport	11.1	-	1.4
University of Buffalo	13.6	-	2.9
University of Connecticut	8.5	5.6	0
University of Maine	11.5	4.5	0

(concluded on next page)

Table 14 Concluded.

College	Mathematics	Military Science	Physical Education
(1)	(2)	(3)	(4)
University of Massachusetts....	10.4	5.8	1.3
University of New Hampshire....	12.5	4.2	1.4
University of Rhode Island.....	12.3	5.4	2.7
University of Rochester.....	9.7	-	2.8
University of Vermont.....	10.5	5.3	2.6
Worcester Polytechnic Institute	10.8	-	2.1
Yale University.....	9.1	-	-
Mean	10.8	2.4	1.3

Table 14 shows that the mean percentage of credits required in the mathematics group of courses was 10.8 per cent, with a minimum of 6.9 and a maximum of 13.9 per cent. This shows a close grouping of required percentages around the mean.

The mean percentage of credits required in the military science group of subjects for the twenty-four selected colleges was 2.4 per cent. This is a special grouping because the federal government requires those institutions that benefit from the Land Grant Act of Congress, to give military science courses. A 0 in grouping signifies that a college required a course or courses in the group but did not give any credits for it. A - in the tabulation signifies that the college did not require any credits in the group.

The average percentage of credits required in the physical education group was 1.3 per cent.

Table 15. Percentage Distribution of Credits in Psychology, and Shop Practice in Twenty-Four Selected Colleges.

College	Psychology	Shop Practice
(1)	(2)	(3)
Bradford Durfee Technical Institute	4.1	3.5
Brown University	-	3.1
City College of New York	-	7.1
Clarkson College	-	-
Columbia University	-	4.9
Cooper Union	-	-
Massachusetts Institute of Technology	-	2.3
New York University	-	-
Norwich University	-	1.3
Polytechnic Institute of Brooklyn	-	-
Pratt Institute	-	1.4
Rensselaer Polytechnic Institute	-	5.4
Tufts College	-	2.1
University of Bridgeport	-	-
University of Buffalo	-	1.4
University of Connecticut	-	-
University of Maine	1.3	2.9
University of Massachusetts	-	4.5
University of New Hampshire	-	-
University of Rhode Island	-	1.4
University of Rochester	-	2.1
University of Vermont	-	-
Worcester Polytechnic Institute	-	7.1
Yale University	-	-
Mean	0.2	2.1

Table 15 shows that the mean percentage of credits required in the psychology group was 0.2 per cent. Only two colleges required courses in this group.

The mean percentage of credits required in the shop practice group was 2.1 per cent. The lowest was zero and the highest was 7.1 per cent. Nine colleges did not require any courses in this group.

CHAPTER III

SUMMARY OF THE FINDINGS

Summary and Comparisons

In making this summary of the findings a continuous comparison will be made between the practice of the selected group of engineering schools and the practice of the Bradford Durfee Technical Institute.

This summary and comparison is presented with a view to discovering clues for possible improvement of the four-year undergraduate mechanical-engineering curricula at the Bradford Durfee Technical Institute.

This study of the four-year undergraduate mechanical-engineering curricula in the twenty-four engineering schools in New England and New York State showed that the mean total credits required for graduation was 146. The minimum number of credits required for graduation was 128. The maximum number of credits required for graduation was 173.5. The average number of credits required per year was 36.5 and the average number of credits required per term was 18.25. The credits required for graduation at the Bradford Durfee Technical Institute were 145.

Six schools required attendance at a summer session.

Another school excused "well qualified students" from the summer school if they completed the summer session courses during the regular school year.

Seventeen out of the twenty-four or 70.8 per cent of the schools did not require attendance at a summer session. The Bradford Durfee Technical Institute did not require attendance at a summer session.

This study showed a total of 164 courses in the four-year undergraduate mechanical-engineering curricula in the selected schools.

In the applied engineering group of courses, all the schools required at least one course in electrical engineering. Twenty-two of the schools required a course in machine design. Nineteen required a course in mechanical-engineering laboratory. Sixteen required a course in power plants. Fourteen required a course in internal-combustion engines and a like number required a course in materials-testing laboratory. The number of schools that required the remaining courses in this group was relatively small. The average number of courses required in each school, in the applied engineering group was 8.0. The mean percentage of credits required in this group was 20.8 per cent of the total credits required for graduation. The minimum was 3.1 per cent and the maximum was 29.3 per cent. The Bradford Durfee Technical Institute required 19.3 per cent of the credits to be in the

the applied engineering group of courses.

In the applied-science group of courses, all the schools required a course in thermodynamics. Twenty-one required a course in fluid mechanics. Fifteen required a course in dynamics and a like number required a course in strength of materials. Thirteen required a course in metallurgy and a like number required a course in statics. Ten required a course in kinematics and a like number required a course in mechanics. The number of schools that required the remaining courses in this group was relatively small. The average number of courses required in the applied-science group was 7.4. The mean percentage of credits required in this group was 19.5 per cent of the total credits required for graduation. The minimum was 16.5 per cent and the maximum was 28.1 per cent. The Bradford Durfee Technical Institute required 17.9 per cent of the credits to be in the applied science group of courses.

In the pure science group of courses, all the schools required a course in physics and in chemistry. One school required a course in physical chemistry, another required a course in atomic physics, and another required a course in modern physics for engineers. The mean percentage of credits required in this group was 13.9 per cent of the total credits required for graduation. The minimum was 9.1 per cent and the maximum was 19.1 per cent. The Bradford Durfee Technical

Institute required 12.4 per cent of the credits to be in the pure science group of courses.

In the business and social studies group of courses, twenty-two of the schools required at least one course in the field of economics, business or management. The number of schools that required the remaining courses in this group was relatively small. The average number of courses required by each school, in the business and social studies group was 2.8. The mean percentage of credits required in this group was 7.0 per cent of the total credits required for graduation. The minimum was zero per cent and the maximum was 17.5 per cent. The Bradford Durfee Technical Institute required 10.3 per cent of the credits to be in the business and social studies group of courses.

In the drafting group of courses, allthe schools required at least one course in drafting and one course in descriptive geometry or instruction in descriptive geometry in a drafting course. The average number of courses required by each school, in the drafting group of courses was 2.2. The mean percentage of credits required in this group was 4.4 per cent of the total credits required for graduation. The minimum was 2.6 per cent and the maximum was 6.3 per cent. The Bradford Durfee Technical Institute required 2.8 per cent of the credits to be in the drafting group of courses.

In the matter of electives, all the schools in this

study required them. Two of the schools allowed a free choice of electives. Sixteen of the schools required non-technical electives and seventeen required technical electives. The mean percentage of credits required in free electives was 0.4 of the total credits. One school required 2.0 per cent and the other school required 8.3 per cent of the total credits to be in free electives. The Bradford Durfee Technical Institute required 8.3 per cent of the credits to be in free electives. In the case of non-technical electives, the percentage of credits required was 5.9 per cent of the total credits, with a minimum of zero and a maximum of 19.0 per cent. The Bradford Durfee Technical Institute did not require any non-technical electives. In the case of technical electives, the mean percentage of credits required was 4.5 per cent of the total credits, with a minimum of zero and a maximum of 13.6 per cent. The Bradford Durfee Technical Institute required 1.4 per cent of the credits to be technical electives.

In the English group of courses, all the schools required courses in English. Twelve of the schools required a course in public speaking and another required a course in technical speeches and reports, making a total of thirteen that required preparation in speech making. The average number of courses required by each school, in the English group was 2.2. The mean percentage of credits required in

this group 6.8 per cent of the total credits. The minimum was 1.4 per cent and the maximum was 11.1 per cent. The Bradford Durfee Technical Institute required 9.0 per cent of the credits to be in the English group of courses.

In the mathematics group of courses, all the schools required courses in calculus. Sixteen required a course in differential equations. All the schools stipulated algebra as a part of the entrance requirements. Twelve required their freshmen to take a course in algebra. The Bradford Durfee Technical Institute required their freshmen to take a course in algebra. Six schools stipulated that the freshmen take a mathematical course which included instruction in trigonometry. These six schools listed trigonometry as an entrance requirement. The Bradford Durfee Technical Institute required their freshmen to take a course in trigonometry. The mean percentage of credits required in the mathematics group of courses was 10.8 per cent of the total credits, with a minimum of 6.9 and a maximum of 13.9 per cent.

In the military science group of courses, eleven of the schools required instruction in this subject. This instruction is required in schools that benefit from the Land Grant Act of Congress. The mean percentage of credits required in this group was 2.4 per cent of the total credits. The minimum was zero and the maximum was 10.7 per cent.

The Bradford Durfee Technical Institute did not require any courses in military science.

In the physical education group of courses, eighteen schools required courses in this group. The six other schools did not require any courses in this group. The mean percentage of credits required in this group was 1.3 per cent of the total credits. The minimum was zero and the maximum was 4.2 per cent. The Bradford Durfee Technical Institute did not require any courses in physical education.

In the psychology group of courses, only two schools required courses in psychology. One school required one course and the other school required two different courses in psychology. The mean percentage of credits required in this group was 0.2 per cent. The minimum was zero and the maximum was 4.1 per cent. The Bradford Durfee Technical Institute required 4.1 per cent of the credits to be in the psychology group of courses.

In the shop practice group of courses, nine schools did not require any shop courses. Six schools required a course in machine tool laboratory and seven others required a shop practice course. These two courses are somewhat similar. The average number of courses required in this group by each school was 0.92. The mean percentage of credits required in this group was 2.1 per cent of the total credits. The minimum was zero and the maximum was 7.1 per cent. The

Bradford Durfee Technical Institute required 3.5 per cent of the credits to be in the shop practice group of courses.

This study showed that 24.0 per cent of the total credits required for graduation were in the general education group of courses. Twenty-four and seven-tenths per cent of the credits were in the mathematics and pure science group of courses. Twenty-three and nine-tenths per cent of credits were in the basic engineering group and 24.4 per cent of the credits were in the specific technological applications group of courses. This is in substantial agreement with the page 6 of this thesis.

The mean percentage of credits required in the various groupings out of the total credits required for graduation was as follows: 20.8 per cent in applied engineering, 19.5 per cent in applied science, 13.9 per cent in pure science, 7.0 per cent in business and social studies, 4.4 per cent in drafting, 6.8 per cent in English, 0.4 per cent in free electives, 5.9 per cent in non-technical electives, 4.5 per cent in technical electives, 10.8 per cent in mathematics, 2.4 per cent in military science, 1.3 per cent in physical education, 0.2 per cent in psychology and 2.1 per cent in shop practice.

Conclusion

The differences set forth under the summary and comparisons should be given further consideration. This should be done with a view to determine whether or not the practices of the majority of the group of selected engineering schools should be followed at the Bradford Durfee Technical Institute.

Mechanical Engineering Curricula at
Bradford Durfee Technical Institute

Subject	Credits
First Year	
Chemistry	10
English Composition	6
Public Speaking	1
College Algebra	5
Trigonometry and Analytic Geometry	5
History of Western Civilization	6
Textile Orientation	1
Technical Elective	2
Second Year	
Descriptive Geometry	2
Engineering Drafting	2
Applied Mechanics	6
Shop Practice	5
English and American Literature	6
Differential Calculus	3
Integral Calculus	3
Physics	8
Third Year	
Principles of Economics	3
Elementary Heat and Power	4
Fluid Mechanics	4
Strength of Materials	6
Mechanism	6
Operation of Textile Machinery	2
Electrical Engineering	8
Economic History of the United States	3
Free Elective	6
Fourth Year	
Thermodynamics	4
Materials Testing Laboratory	2
Machine Design	6
Tool and Jig Design	6
Principles of Psychology	3
Industrial Psychology	3
Industrial Management	2
Free Elective	6

Mechanical Engineering Curricula at Brown University

Subject	Credits
First Year	
Chemistry	8
English	8
Analytic Geometry and Calculus	8
Physics	8
Physical Education	0
Second Year	
Calculus	4
Engineering Drawing	4
Descriptive Geometry	4
Shop Practice	4
Electricity and Magnetism	8
Humanities Elective	8
Third Year	
Modern Physics for Engineers	8
Social Study Elective	8
Statics	4
Dynamics	4
Electrical Engineering	4
Fluid Mechanics	4
Fourth Year	
Mechanics of Materials	4
Mechanics of Materials and Structures	4
Thermodynamics	8
Engineering Economy	4
Engineering Electives	12

Mechanical Engineering Curricula at City College of New York

Subject	Credits
First Year	
Chemistry	3
English	2
Hygiene	3
Social Studies	3
Speech	1
Analytic Geometry and Calculus	5
Calculus	5
Physics	8
Descriptive Geometry and Drafting	2
Second Year	
Humanities	6
Differential Equations	3
Mechanics	4
Atomic Physics	3
Descriptive Geometry	2
Mechanical Drawing	2
Mechanics of Materials	4
English	2
Hygiene	1
Social Studies	6
Speech	2
Chemistry	3
Third Year	
Machine Design	2
Materials of Engineering	3
Engineering Fluid Mechanics	3
Electrical Engineering	3
Mechanics	5
Alternating Circuits	3
Power Generation	4
Metal Processing Laboratory	2
Thermodynamics	3
Shop Processes	2
Mechanical Engineering Laboratory	1
Heat Transfer	2
Electrical Machinery	3
Fourth Year	
Mechanical Engineering Laboratory	1
Shop Processes	6
Electrical Machinery	3

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Mechanical Engineering Curricula at
City College of New York. (Concluded)

Subject	Credits
Fourth Year (Concluded)	
Structural Planning and Design	3
Electrical Machinery Laboratory	2
Engineering Economy	3
Internal Combustion Engines	4
Machine Design	6
Heating, Air Conditioning, Ventilating and Refrigeration	3
Power Plant Engineering	3

Note. "A summer session must be attended to complete some of the required courses listed in the third or fourth year, to be selected by the faculty."

Mechanical Engineering Curricula at Clarkson College of Technology.

Subject	Credits
First Year	
Chemistry	8
English	6
Algebra and Trigonometry Review	4
Differential Calculus	4
Engineering Drawing	4
Physics	6
Physical Education or Military Science	4
Summer Session (after first year)	
Mechanics, Statics	3
Oral English	2
Integral Calculus	3
Second Year	
Strength of Materials	3
Humanities	6
Differential Equations	3
Applied Mathematics	3
Mechanism	3
Engineering Materials and Manufacturing	4
Metallurgy and Metallography	2
Mechanics, Dynamics	3
Materials Laboratory	1
Physics	8
Physical Education or Military Science	4
Third Year	
Economics	6
Fluid Mechanics	3
Electrical Engineering	6
Thermodynamics	8
Mechanics of Machines	3
Fluid Mechanics Laboratory	1
Physical Chemistry	2
Modern Civilization	3
Machine Design	3
Engineering Materials and Manufacturing	2
Fourth Year	
Applied Thermodynamics	8
Mechanical Engineering Laboratory	4
Technical Electives	15
Liberal Studies Elective	3
Modern Civilization	3
Machine Design	3

Mechanical Engineering Curricula at
Columbia University.

Subject	Credits
First Year	
English	2
Contemporary Civilization	8
Chemistry	9
Trigonometry	3
Calculus	3
Health Education	2
Physics	5
Physical Education	2
Second Year	
Humanities	8
Calculus	6
Physics	8
Statics and Kinematics	3
Dynamics	3
Engineering Drawing	3
Descriptive Geometry	3
Physical Education	2
Summer Session (after second year)	
Elementary Surveying	2
Community Surveys	3
Third Year	
Contemporary Civilization	6
Strength of Materials	3
Electrical Machinery	4
Engineering Library Technique	1
Engineering Materials	3
Thermodynamics	4
Fluid Dynamics	3
Machine Design	3
Shop Processes	3
Indication and Control	3
Mechanical Engineering Laboratory	3
Fourth Year	
Engineering Economics	2
Engineering Electronics	2
Strength of Materials Laboratory	1
Power Plants	3
Engineering Heat Transfer	3
Engineering Fluid Acceleration and Displace	3
Engineering Mechanics	3
Technical Elective	3

Mechanical Engineering Curricula at Cooper Union

Subject	Credits
First Year	
Descriptive Geometry	3
Engineering Drawing	3
English	8
Chemistry	11
Algebra and Trigonometry	4
Analytic Geometry and Calculus	4
Orientation	1
Physics	7
Physical Education	2
Summer Session (after first year)	
Surveying Field Work	2
Second Year	
Engineering Mechanics	3
Calculus	5
Differential Equations	3
Physical Metallurgy	3
Public Speaking	2
Civilization	3
Fluid Mechanics	3
Kinematics of Machines	3
Kinematics of Machines Drawing	1.5
Physics	9.5
Third Year	
Economics	4
Electrical Engineering	4
Electrical Engineering Laboratory	1.5
Mechanical Processes	3
Mechanics of Materials	3
Thermodynamics	5
Fluid Machines	2
Machine Design	2
Machine Design Drawing	1.5
Mechanical Engineering Laboratory	1.5
Civilization	4
Fourth Year	
Combustion Engines and Turbines	2
Engineering Economy	3
Industrial Organization	2
Heat Transfer	2
Humanities Elective	4

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Mechanical Engineering Curricula at Cooper Union. (Concluded)

Subject	Credits
Fourth Year (Concluded)	
Air Conditioning and Refrigeration	2
Machine Dynamics	2
Machine Dynamics Drawing	1.5
Power Plants	2
Civilization	4
Machine Design	2
Machine Design Drawing	1.5
Mechanical Engineering Laboratory	3.5

Mechanical Engineering Curricula at
Massachusetts Institute of Technology.

Subject	Credits
First Year	
Chemistry	11
English Composition	6
Physics	10
Engineering Drawing	3
Descriptive Geometry	3
Calculus	6
Military Science	5
Athletics	2
Second Year	
Statics	3
Dynamics	3
Machine Drawing	3
Machine Tool Laboratory	4
History-Humanities	6
Differential Equations	3
Physics	9
Calculus	3
Military Science	5
Third Year	
Strength of Materials	3
Fluid Mechanics	5
Heat Engineering	7
Machine Design	6
Dynamics	3
Electrical Engineering	4
Economic Principles-Humanities	3
Testing Materials Laboratory	2.5
Humanity Elective	3
Fourth Year	
Strength of Materials	3
Heat Engineering	3
Engineering Laboratory	2.5
Metal Processing	3
Humanity Elective	6
Professional Electives	18
Thesis	9
Mechanical Engineering Problems	3
Power Plant Engineering	4.5

Mechanical Engineering Curricula at
New York University.

Subject	Credits
First Year	
Chemistry	8
Engineering Drawing	3
Descriptive Geometry	2
English	5
Speech	2
Calculus	8
Physics	5
Military Science	4
Second Year	
Statics	3
Technical Writing	2
Differential Equations	3
Mechanical Instrumentation	1
Mechanical Measurements	1
Principles of Economics	2
Survey of Scientific Literature	2
Dynamics	3
Manufacturing Tools and Methods	2
Manufacturing Tools and Methods Laboratory	1
Thermodynamics	3
Calculus	4
Physics	5
Military Science	4
Third Year	
D. C. Machinery	2
D. C. Machinery Laboratory	1
Mechanics of Materials	4
Fluid Mechanics	3
Fluid Mechanics Laboratory	1
Humanities	6
Thermodynamics	3
Thermodynamics Laboratory	2
Engineering Materials	3
A. C. Machinery	3
A. C. Machinery Laboratory	1
Materials Testing Laboratory	1
Applied Kinematics	3
Internal Combustion Engines	3

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Mechanical Engineering Curricula at New York University. (Concluded)

Subject	Credits
Fourth Year	
Social Studies	6
Internal Combustion Engines Laboratory	1
Machine Design	4
Engineering Economics	2
Mechanical Laboratory	2
Technical Speeches and Reports	1
Engineering Electives	18

Mechanical Engineering Curricula at Norwich University.

Subject	Credits
First Year	
Chemistry	8
English	6
Algebra and Plane Geometry	5
Algebra, Trigonometry and Calculus	5
Mechanical Drawing	3
Descriptive Geometry	3
Engineering Survey	0
Military Science	4
Second Year	
Surveying	3
English, Technical Composition	3
Public Speaking	3
Calculus	3
Differential Equations	4
Shop Practice	2
Physics	14
Mechanics	3
Military Science	4
Third Year	
Engineering Economics	3
American Government	3
Kinematics	2
Thermodynamics	3
Mechanics	3
Strength of Materials	4
Testing Materials Laboratory	2
Engineering Materials and Processes	3
Steam, Air and Gas Power	3
Fluid Mechanics	3
Mechanical Engineering Laboratory	2
Elective	3
Military Science	4
Fourth Year	
Electrical Engineering	6
Machine Design	6
Heat Transfer	3
Seminar in Mechanical Engineering	2
Physical Metallurgy	3
Refrigeration and Air Conditioning	3
Internal Combustion Engines	3
Engineering Electives	6
Mechanical Engineering Laboratory	4
Military Science	4

Mechanical Engineering Curricula at
Polytechnic Institute of Brooklyn.

Subject	Credits
First Year	
English	8
History	6
Trigonometry and Algebra	4
Analytic Geometry and Calculus	4
Technical Sketching	2
Physics	10
Engineering Drawing and Descriptive Geom.	2
Physical Education	0
Orientation	0
Second Year	
English	4
History	4
Analytic Geometry and Calculus	8
Physics	4
Engineering Drawing and Descriptive Geom.	2
Chemistry	8
Production Processes	5
Mechanics	2
Physical Education	0
Third Year	
Mechanics of Materials	3
Economics	6
Differential Equations	4
Metallurgy	4
Thermodynamics	7
Fluid Mechanics,	4
Structures	2
Machine Elements	3
Engineering Materials	2
Career Planning	0
Mechanics	2
Fourth Year	
Electrical Engineering	7
Public Speaking and Report Writing	4
Machine Design	6
Combustion Engines	4
Power Plants	3
Industrial Economics	4
Engineering Problems	3
Thesis or Technical Elective	3

Mechanical Engineering Curricula at Pratt Institute.

Subject	Credits
First Year	
Algebra and Trigonometry	4
Physics	8
Chemistry	8
English	6
Engineering Drawing and Descriptive Geom.	4
Metal Casting Laboratory	1
Metal Working Processes	1
Orientation	0
Physical Education or Military Science	0
Analytic Geometry and Calculus	4
Second Year	
Calculus	8
English and American Literature	4
Fundamentals of Design	3
Thermodynamics	8
Machine Tool Laboratory	1
Statics and Dynamics	4
Physical Education or Military Science	0
Physics	8
Third Year	
Differential Equations	3
Electrical Engineering	4
Mechanics of Materials	4
Heat Transfer and Fluid Flow	3
Economic Institutions	3
Inspection Methods	1
Electrical Machinery	4
Industrial Administration	3
Production Design	3
Fundamentals of Design	4
Thermodynamics	4
Fourth Year	
Social Institutions	3
Political Institutions	3
Metallurgy	3
Mechanical Vibrations	3
Power Plants	3
Structures	3
Inspection Trip	0
Reports and Correspondence	3

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Mechanical Engineering Curricula at Pratt Institute. (Concluded)

Subject	Credits
Fourth Year (Concluded)	
Industrial Leadership	3
Machine Design	3
Instruments and Control	3
Conferences	0
Industrial Marketing	3
Mechanical Laboratory	3

Note: A program of readins in literature, history of civilization and the social sciences is required to be done independently during the summer. Evidence of the accomplishment is furnished by examinations or written reports.

Mechanical Engineering Curricula at
Rensselaer Polytechnic Institute.

Subject	Credits
First Year	
Engineering Drawing	3
Descriptive Geometry	2
English	3
Historical Backgrounds of Modern World	3
Introduction to Engineering and Science	1
Differential Calculus	4
Integral Calculus	4
Physical Training	2
Physics	6
Shop Processes	4
Metal Casting	4
Second Year	
English	3
Differential Equations	3
Chemistry	10
Engineering Mechanics	4
Economic and Social Principles	3
Dynamics of Liquids	4
Non Technical Elective	3
Physical Training	2
Physics	8
Third Year	
Economic and Social Problems	3
Electrical Engineering	8
Heat Engineering	8
Engineering Metallurgy	3
Applied Composition	3
Strength of Materials	4
Engineering Mathematics	3
Non Technical Elective	3
Fourth Year	
Heat Transfer	4
Machine Design	8
Industrial Engineering	3
Manufacturing Engineering	3
Technical Electives	14
Engineering Thermodynamics	4

Mechanical Engineering Curricula at Tufts College.

Subject	Credits
First Year	
Chemistry	8
Engineering Drawing	4
Descriptive Geometry	2
English	6
Analytic Geometry and Calculus	7
Physics	4
Physical Education	2
Second Year	
Statics	3
Dynamics	2
D. D. Circuits and Machinery	4
Calculus	6
Heat Power	4
Machine Tool Laboratory	3
Mechanism	2
Humanistic and Social Studies	6
Physics	8
Physical Education	1
Third Year	
Strength of Materials	5
Fluid Mechanics	3
A. C. Circuits	3
Differential Equations	3
Thermodynamics	7
Mechanics of Machinery	3
Machine Design,	3
Technical Elective	3
Humanistic and Social Studies	6
Fourth Year	
A. C. Machinery	4
Internal Combustion Engines	4
Dynamics and Vibrations	3
Power Plants	4
Heating, Ventilating and Air Conditioning	3
Industrial Management	3
Refrigeration	3
Technical Electives	6
Humanistic and Social Studies	6

Mechanical Engineering Curricula at
University of Bridgeport.

Subject	Credits
First Year	
Algebra, Trigonometry and Analytic Geometry	8
Chemistry	8
Physics	6
Health Education	2
Engineering Orientation	0
Engineering Drawing	3
Descriptive Geometry	3
Physical Education	0
Summer Session (After first year)	
English	6
Surveying	2
Manufacturing Processes	3
History or Political Science	3
Second Year	
Calculus	8
Effective Speech	4
Introduction to Industrial Engineering	3
Analytical Mechanics	3
Machine Drawing	3
Mechanism	3
Engineering Materials	2
Physical Education	0
Physics	6
Third Year	
Analytical Mechanics	3
Strength of Materials	3
Advanced Mechanics	3
Thermodynamics	6
Steam Power Stations	3
Fluid Mechanics	3
Metallurgy	3
Mechanical Engineering Laboratory	1
Principles of Economics	6
History of Political Science	3
Fourth Year	
Mechanical Engineering Laboratory	2
Machine Design	6
Advanced Dynamics	3
Heating, Ventilating and Air Conditioning	3

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Mechanical Engineering Curricula at
University of Bridgeport (Concluded)

Subject	Credits
Fourth Year (Concluded)	
Electrical Engineering	6
Electrical Engineering Laboratory	2
Internal Combustion Engines	3
Refrigeration	3
Seminar	0
Humanities Elective	6

Note: "Very well qualified students may request permission to eliminate the summer session by carrying heavier programs of studies." 1/

1/ University of Bridgeport, Catalog 1950-1951, Bridgeport. p. 95.

Mechanical Engineering Curricula at University of Buffalo.

Subject	Credits
First Year	
College Algebra	3
Analytic Geometry	3
Calculus	4
Inorganic Chemistry	8
Composition and Introduction to Literature	6
Engineering Computation	2
Mechanical Drawing	3
Descriptive Geometry	3
Physical Education	2
Approved Elective	2
Second Year	
Calculus	4
Physics	10
Statics	3
Dynamics	3
Manufacturing Processes	2
Manufacturing Processes Laboratory	1
Metallurgy	3
Economics	3
Machine Drawing	2
Differential Equations	3
Physical Education	2
Third Year	
Mechanics of Materials	3
Mechanics of Materials Laboratory	1
Economics	3
Fluid Mechanics	3
Fluid Mechanics Laboratory	1
Thermodynamics	6
Elementary Heat and Power	2
Mechanical Engineering Laboratory	1
Precision Gage Laboratory	2
Machine Design	6
Approved Elective	6
Fourth Year	
Structures	3
Mechanics-Advanced Topics	3
Senior Design	3
Electrical Engineering Theory	5
Electrical Engineering Laboratory	2
Heat Transfer	2
Mechanical Engineering Laboratory	4
Senior Technical Elective	6
Approved Elective	6

Mechanical Engineering Curricula at University of Connecticut.

Subject	Credits
First Year	
Chemistry	8
Non Technical Elective	6
English	6
Orientation	0
Calculus	3
Analytic Geometry	3
Engineering Drawing and Descriptive Geometry	3
Engineering Drawing	3
Military Science	4
Physical Education	0
Second Year	
Applied Mechanics	3
Strength of Materials	3
English (Introduction to Literature)	3
English Composition	3
Calculus	3
Differential Equations	3
Non Technical Elective	6
Physics	8
Military Science	4
Third Year	
Materials Testing Laboratory	1
Electrical Engineering	6
Electrical Engineering Laboratory	2
Machine Processes	2
Mechanical Engineering Laboratory	2
Thermodynamics	3
Metallurgy	3
Metallurgy Laboratory	1
Mechanism	3
Heat Engines	3
Non Technical Electives	6
Applied Mechanics	3
Fourth Year	
Mechanical Engineering Laboratory	2
Fluid Mechanics	3
Dynamics of Machines	3
Machine Design	6
Power Plants	3
Heat Transfer	2
Internal Combustion Engines	3
Air Conditioning and Refrigeration	3
Seminar	1
Non Technical Electives	9

Mechanical Engineering Curricula at
University of New Hampshire.

Subject	Credits
First Year	
Physical Education	1
Military Science	3
Chemistry	8
English	6
Algebra	3
Trigonometry	3
Analytic Geometry	3
Calculus	3
Engineering Drawing and Descriptive Geometry	4
Second Year	
Physical Education	1
Military Science	3
Economics	6
Machine Drawing	2
Calculus	6
Kinematics	3
Manufacturing Processes	4
Physics	12
Third Year	
Non Technical Electives	6
Electrical Machinery	8
Mechanics	8
Mechanical Engineering Materials	5
Thermodynamics	6
Mechanical Engineering Laboratory	4
Engineering Addresses	0
Fourth Year	
Non Technical Electives	6
Mechanical Engineering Laboratory	2
Engineering Addresses	0
Fluid Mechanics	3
Technical Reports	2
Machine Design	6
Power Plants	5
Internal Combustion Engines	6
Engineering Economy	3
Industrial Management	3

Mechanical Engineering Curricula at University of Maine.

Subject	Credits
First Year	
Chemistry	8
Freshman Composition	6
Fundamentals of Drafting	2
Trigonometry	2
Algebra	2
Physics	10
Machine Drafting	2
Analytic Geometry and Calculus	4
Military Science	3
Physical Education	0
Second Year	
Surveying	3
Descriptive Geometry	2
Gage Laboratory and Pattern Work	1.5
Materials of Engineering	2
Calculus	10
Public Speaking	2
Modern Literature	2
Materials Laboratory	1.5
Elements of Mechanical Engineering	2
Mechanical Laboratory	1.5
Applied Mechanics, Statics	3
Non Technical Electives	6
Military Science	4
Physical Education	0
Third Year	
Technical Composition	2
Machine Tool Laboratory	3
Kinematics	4
Thermodynamics	6
Mechanical Laboratory	3
Strength of Materials	4
Business Law	3
Electric Circuits	2
Machine Design	3
Applied Mechanics, Dynamics	3
Applied Psychology	2
Non Technical Electives	6

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Mechanical Engineering Curricula at University of Maine. (Concluded)

Subject	Credits
Fourth Year	
Applied Electronics	2
Fluid Mechanics	3
Mechanical Laboratory	3
Modern Turbines	3
Advanced Machine Design	2
Heating and Air Conditioning	3
Internal Combustion Engines	3
Electrical Machinery	2
Electrical Laboratory	1.5
Industrial Management and Safety Engineering	3
Power Plants	3
Seminar	1
Non Technical Electives	6

Mechanical Engineering Curricula at University of Massachusetts.

Subject	Credits
First Year	
English Composition	4
Public Speaking	2
Analytic Geometry	4
Differential Calculus	4
Physics	8
Engineering Drawing	4
Military Science	5
Physical Education	2
Non Technical Electives	6
Summer (After first year)	
Pattern Making and Welding	3
Machine Shop	3
Second Year	
English Literature	6
Integral Calculus	4
Differential Equations	4
General Chemistry	6
Descriptive Geometry	2
Materials of Construction	2
Metallurgy	3
Production Processes	2
Applied Mechanics, Statics	3
Military Science	4
Third Year	
Economics or Psychology	6
Applied Mechanics, Kinetics	3
Mechanical Instrumentation Laboratory	1
Electrical Engineering	8
Thermodynamics	7
Strength of Materials	4
Testing of Materials	2
Fluid Mechanics	4
Kinematics	3

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Mechanical Engineering Curricula at University of Massachusetts. (Concluded)

Subject	Credits
Fourth Year	
Power Plants	3
Internal Combustion Engines	3
Mechanical Engineering Laboratory	4
Machine Design	3
Advanced Machine Design	3
Dynamics of Machines	3
Refrigeration and Air Conditioning	3
Mechanical Engineering Seminar	1
Non Technical Electives	6
Technical Electives	6

Mechanical Engineering Curricula at
University of Rhode Island

Subject	Credits
First Year	
Chemistry	8
English	6
Algebra	3
Trigonometry	3
Analytic Geometry	3
Calculus	3
Mechanical Drawing	2
Descriptive Geometry	3
Orientation	0
Physical Education	2
Military Science	4
Second Year	
Report Writing	3
Public Speaking	3
Differential Equations	3
Calculus	3
Elementary Mechanical Engineering	2
Kinematics	3
Physics	10
Elementary Heat and Power	2
Statics	3
Physical Education	2
Military Science	4
Third Year	
Fuels and Engineering Chemistry	3
Strength of Materials	3
Strength of Materials Laboratory	1
Machine and Tool Drafting	2
Thermodynamics	6
Dynamics	3
Metallurgy	3
Machine Tool Laboratory	2
Machine Design	2
Mechanical Engineering Laboratory	1
Fluid Mechanics	3
Non Technical Electives	6

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Mechanical Engineering Curricula at University of Rhode Island. (Concluded)

Subject	Credits
Fourth Year	
Electrical Engineering	4
Machine Design	4
Power Plants	3
Internal Combustion Engines	2
Business Organization and Management	3
Fluid Mechanics Laboratory	1
Vibrations and Lubrication	3
Engineering Analysis	3
Engineering Electives	6
Mechanical Engineering Laboratory	2
Non Technical Electives	6

Mechanical Engineering Curricula at University of Rochester.

Subject	Credits
First Year	
Chemistry	8
Engineering Drawing	2
Descriptive Geometry	2
Engineering Lectures	1
English	6
Analytic Geometry and Calculus	8
Non Technical Electives	6
Physical Education	2
Second Year	
Analytic Geometry and Calculus	3
Economics	6
Differential Equations	3
English Literature	6
Physics	8
Analytical Mechanics	6
Foundry Lectures	1
Machine Shop	2
Shop Drawing	2
Physical Education	2
Third Year	
Metallurgy	3
Metallurgical Design	3
Mechanics of Materials	3
Kinematics of Machines	4
Thermodynamics	6
Electrical Engineering	8
Materials Laboratory	2
Fluid Mechanics	3
Mechanics of Machines	3
Fourth Year	
Fluid Mechanics Laboratory	2
Steam Power Plants	3
Heat Power Laboratory	4
Electrical Laboratory	2
Industrial Organization	3
Time and Motion Study	3
Structural Design and Drawing	3
Technical Electives	9
Non Technical Electives	6

Mechanical Engineering Curricula at University of Vermont.

Subject	Credits
First Year	
Algebra and Trigonometry	5
Analytic Geometry and Spherical Trigonometry	5
Chemistry	10
Engineering Drawing	6
English Composition	6
Military Science	4
Physical Education	2
Second Year	
Calculus	6
Physics	10
Manufacturing Processes	4
Expository Writing	3
Public Speaking	3
Elements of Mechanical Engineering	3
Statics	3
Military Science	4
Physical Education	2
Third Year	
Kinematics	4
Mechanics of Materials	3
Materials Laboratory	1
Electric Circuits and Machinery	8
Industrial Metallurgy	4
Kinetics	3
Thermodynamics	4
Fluid Mechanics	4
Economics	6
Mechanical Engineering Laboratory	1
Fourth Year	
Machine Design	8
Power Plants	4
Internal Combustion Engines	4
Technical Electives	6
Contracts	2
Seminar	2
Non Technical Electives	12

Mechanical Engineering Curricula at Worcester Polytechnic Institute.

Subject	Credits
First Year	
General Chemistry	3
Chemistry of Engineering Materials	3
History of Language	4
English Composition or Reading	4
Trigonometry, Analytic Geometry, Calculus	5
Analytic Geometry and Calculus	5
Engineering Drawing	4
Physics	6
Physical Education	2
Second Year	
History or Language	4
Physics	8
Surveying	2
Drama	2
Public Speaking	2
Calculus	3
Calculus and Differential Equations	3
Descriptive Geometry	3
Machine Drawing	2
Statics	3
Shop Processes	4
Physical Education	1
Summer Session (After second year)	
Shop Production Methods	1.5
Third Year	
Economics	2
Industrial Economics	2
Shop Processes	5
Mechanism	3.5
Heat and Power	7
Heat and Power Laboratory	2
Strength of Materials	4
Strength of Materials Laboratory	2
Kinetics	3
Design of Machinery	2
Summer Session (After second year)	
Plant Inspections or Aerodynamics	3

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Mechanical Engineering Curricula at Worcester Polytechnic Institute. (Concluded)

Subject	Credits
Fourth Year	
Electrical Engineering	3
Electrical Engineering Applications	2
Heat and Power	3
Fluid Mechanics	3
Mechanical Engineering Laboratory	6
Electric Control	2
Hydraulic Machinery	3
Graphics and Statics	2
Humanities Electives	6
Technical Electives	5

Note. "Every student, unless excused for adequate reasons, shall be required to read a predetermined number of books each year after the freshman year. It is expected that the summer recess will be utilized for this purpose. The English Department will examine students in the fall of each year to determine whether they are entitled to reading credit, and such credit must be established to qualify for promotion to the junior and senior classes and for graduation." 1/

1/Worcester Polytechnic Institute, Catalog 1950-1951, p.53.

Mechanical Engineering Curricula at Yale University.

Subject	Credits
First Year	
English	6
Analytic Geometry and Calculus	6
Engineering Drawing	6
Chemistry	10 a/
Technical Electives	
Second Year	
Kinematics	3
Mechanical Technology	3
Economics	6
Statics	3
Dynamics	3
Calculus	6
Physics	10
Third Year	
Machine Design	3
Thermodynamics	6
Thermodynamics Laboratory	1
Strength of Materials	3
Strength of Materials Laboratory	2
English Literature	6
Metals and Alloys	3
Technical Electives	6
Fourth Year	
Mechanics of Machines	3
Internal Combustion Engines	4
Electrical Engineering	8
Industrial Engineering	6
Advanced Design	3
Heat and Power	3
Heat and Power Laboratory	1
Technical Electives	6

a/ "An elective may be substituted for chemistry if a student received a satisfactory grade in an acceptable course in preparatory school."

b/ Yale University, Bulletin 1951-1952, Series 47, Number 12, p. 43.

BIBLIOGRAPHY

BIBLIOGRAPHY

Burchard, John Ely, "The Humanities and the Social Sciences in a Technological Education." The Journal of Higher Education (April, 1949), 2:174.

Committee on Undergraduate Curricula, American Society for Engineering Education, "Principles Which Should Guide the Development of an Undergraduate Program in Engineering," Journal of Engineering Education (September, 1949), 40:54.

Hammond, H.P., "How Can the Effectiveness of Engineering Education be Improved," Mechanical Engineering (September, 1949), 71:739.

Hollister, S.C., C.S. Crouse, L.F. Grant, M.D. Hoven, Report of the Committee on Adequacy and Standards of Engineering Education, Engineers' Council for Professional Development, Nineteenth Annual Report, September 30, 1951, New York, N.Y., p. 19.

Jackson, Dugald C., Present Status and Trends of Engineering Education in the United States, Engineers' Council for Professional Development, New York, N.Y. 1939.

Office of Education, Federal Security Agency, Education Directory, Part 3, Higher Education, 1950-51, Washington, D.C. 1950.

Society for the Promotion of Engineering Education, "Report of the Committee on Engineering Education After the War," Journal of Engineering Education (May, 1944), 34:593-594.

College Bulletins

Bradford Durfee Technical Institute, Bulletin, Fall River, Massachusetts, 1951. 51pp.

Brown University, General Catalogue 1950-1951, Providence, Rhode Island, 1951. 302pp.

City College of New York, Bulletin 1951-1952, New York, New York, 1951. 71pp.

Clarkson College, Catalogue Issue 1951 and 1952, Potsdam, New York, 1951. 116pp.

Columbia University, Bulletin, School of Engineering, 1951-1952, New York, New York, 1951. 175pp.

Cooper Union, School of Engineering, 1951-52, New York, New York, 1951. 101pp.

Massachusetts Institute of Technology, Catalogue Issue for 1950-1951 Session, Cambridge, Massachusetts, 1950. 208pp.

New York University, College of Engineering Announcement 1951-1952, New York, New York, 1951. 139pp.

Norwich University, Catalogue 1951, Northfield, Vermont, 1951. 124pp.

Polytechnic Institute of Brooklyn, Catalogue for 1951-1952, Brooklyn, New York, 1951. 119pp.

Pratt Institute, Bulletin 1951-1952, Brooklyn, New York, 1951. 151pp.

Rensselaer Polytechnic Institute, Catalogue 1951, Troy, New York, 1951. 214pp.

Tufts College, Bulletin 1950-1951, Medford, Massachusetts, 1951. 264pp.

University of Bridgeport, 1951-1952 Supplement to the 1950 1951 Catalogue, Bridgeport, Connecticut, 1951. 30pp.

University of Bridgeport, Catalogue 1950-1951, Bridgeport, Connecticut, 1950. 160pp.

University of Buffalo, Catalogue 1951-1952, Buffalo, New York, 1951. pp247-277.

University of Connecticut, Catalogue 1951-52, Storrs, Connecticut, 1951. 336pp.

University of Maine, Catalogue for 1951, Orono, Maine, 1951. 258pp.

University of Massachusetts, Bulletin 1950-51, Amherst, Massachusetts, 1950. 272 pp.

University of New Hampshire, Bulletin 1951-1952, Durham, New Hampshire, 1951.

University of Rhode Island, Catalogue Number 1950, Kingston, Rhode Island, 1950. 242pp.

University of Rochester, Bulletin 1951-1952, Rochester, New York, 1951. 200pp.

University of Vermont, Bulletin 1951, Burlington, Vermont, 1951.261pp.

Worcester Polytechnic Institute, Catalogue 1950-1951, Worcester, Massachusetts, 1950. 106pp.

Yale University, Bulletin 1951-1952, New Haven, Connecticut, 1951. 83pp.