

LAKEHEAD UNIVERSITY

Proposed Degree Program  
in  
School of Engineering

LAKEHEAD UNIVERSITY

PROPOSED DEGREE PROGRAM  
in  
SCHOOL OF ENGINEERING

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### Current Programs

Within the past 5 years, there has been a marked increase in interest in Engineering Technology, both on the part of high school graduates and employers. As a result of this increased interest, Lakehead University now offers specialized programs in four fields of Engineering Technology.

1. Chemical Engineering Technology  
(Pulp and Paper)
2. Civil Engineering Technology
3. Electronics Engineering Technology
4. Mechanical Engineering Technology

The Centennial Building, currently under construction and scheduled for completion in 1968-69, has been designed to include ample facilities for this program. The equipment budget of one half million dollars will provide the essential apparatus for the laboratories. The program will be operating in the 1968/9 academic year. Admission to these programs will be from Grade 12, the 5-year stream.

In addition, the first year only of an Engineering degree program will continue to be offered in 1968/9, along with the first year only of the Ryerson Architecture diploma program.

Objectives 1968 - 1975

Lakehead University now proposes to introduce a new concept (in Ontario) in degree programs in Engineering. It is proposed that, beginning in 1970/71, a fourth and fifth year be introduced for carefully selected graduates of diploma programs in the four fields of engineering listed above. Students who complete these two additional years would receive a degree in Engineering.

The year 1970/71 was selected because this will coincide with the first graduating classes in Engineering Technology from Ontario's newly established Colleges of Applied Arts and Technology. For the current year the total enrolment in Engineering Technology in this Province is 4,550 (Ryerson 1,600, other CAAT's 2,950). It has been estimated that in 1970, the number of graduates will exceed 2,500. Past experience indicates that a significant number of these graduates want to go on in a degree program, with advanced standing. The fourth and fifth years proposed at Lakehead have been especially designed for them.

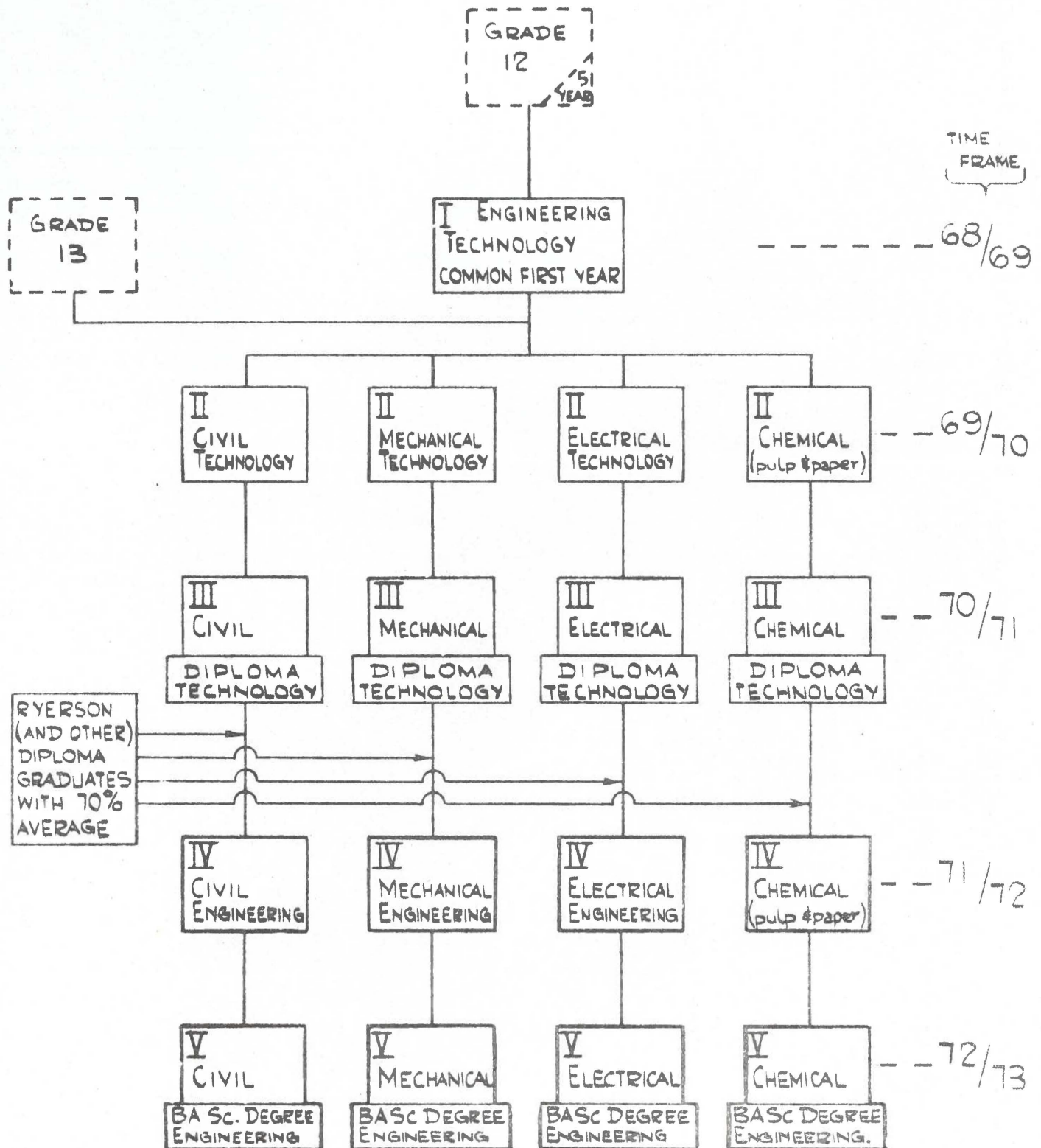
At the present time, some of these graduates are being admitted to established degree programs in Engineering, at the second and, in some cases, at the third year level. A large number of graduates have gone on to Schools of Engineering in the United States and a very large percentage of them remained there after graduation.

Graduates of three-year diploma programs who have been admitted to degree programs have, of necessity, been required to "fit into" existing programs which have been designed for students entering directly from high school. Experience has shown them to be ahead of these students in some areas and behind them in others.

The four degree programs (Civil, Electrical (Electronic), Mechanical and Chemical (Pulp and Paper)) proposed for Lakehead University School of Engineering have been specifically designed for students who have completed the corresponding three-year diploma programs with an average of 70% or better. Graduates from Ryerson and from all CAAT's will also be eligible for admission.

# LAKEHEAD UNIVERSITY

# SCHOOL OF ENGINEERING



DATED: 6 SEPT 67

PROGRAM NETWORK

TENTATIVE BUDGET FOR FOURTH AND FIFTH YEAR OF  
DEGREE PROGRAM IN ENGINEERING

Detailed budget analysis, based on careful estimates of income and expenditures, have been prepared for each year up to 1974-75. Enrollment in each program for 1965 to 1975 is shown on Table I. Total Faculty required in Engineering, Arts and Science are shown on Table II. Budget analysis is summarized on Table III.

It is evident that the four diploma programs which are already established can be operated within the formula.

The addition of the fourth and fifth years, providing for degrees in the same four fields of engineering will increase the annual operating budget by \$220,000 to \$250,000. The estimated enrolment in the fourth and fifth year (1971-72) is just over 200 students. No additional space will be required, but there will be a modest requirement of approximately \$280,000 for additional equipment. Once again, it is evident that the entire program proposed for the School of Engineering can operate within the formula.

# ESTIMATES OF ENROLMENT IN THE SCHOOL OF ENGINEERING - (Dec. 1967)

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|                                        | 1967                        | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 |
|----------------------------------------|-----------------------------|------|------|------|------|------|------|------|------|
|                                        | 1968                        | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 |      |
| Diploma or Associate<br>Degree Program | Civil Technology I          | 40a  | 20a  | 24   | 30   | 35   | 42   | 42   | 42   |
|                                        | Civil Technology II         | 24   | 25   | 13   | 26b  | 25c  | 28c  | 28c  | 28c  |
|                                        | Civil Technology III        | -    | -    | -    | 10   | 21   | 21   | 21   | 21   |
|                                        | Electronic Technology I     | 21a  | 30a  | 36   | 43   | 50   | 58   | 58   | 58   |
|                                        | Electronic Technology II    | -    | -    | 20   | 42b  | 38c  | 42c  | 42c  | 42c  |
|                                        | Electronic Technology III   | -    | -    | -    | 16   | 36   | 34   | 34   | 34   |
|                                        | Mechanical Technology I     | -    | 20a  | 24   | 30   | 35   | 42   | 42   | 42   |
|                                        | Mechanical Technology II    | -    | -    | 13   | 28b  | 25c  | 28c  | 28c  | 28c  |
|                                        | Mechanical Technology III   | -    | -    | -    | 10   | 21   | 21   | 21   | 21   |
|                                        | Pulp & Paper Technology I   | -    | 15a  | 18   | 22   | 25   | 30   | 30   | 30   |
|                                        | Pulp & Paper Technology II  | -    | -    | 10   | 12   | 17c  | 20c  | 20c  | 20c  |
|                                        | Pulp & Paper Technology III | -    | -    | -    | 14   | 10   | 13   | 13   | 13   |
|                                        | Ryerson Arch. Tech. I       | 16   | 16   | 16   | 18   | 20   | 20   | 20   | 20   |
|                                        | Mining Technology           | 4    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
|                                        | Total Technology            | 105  | 126  | 174  | 301  | 358  | 399  | 399  | 399  |
| Degree Program                         | Civil Engineering IV        | -    | -    | -    | 30d  | 35   | 40   | 40   | 40   |
|                                        | Civil Engineering V         | -    | -    | -    | -    | 25   | 30   | 30   | 30   |
|                                        | Electric Engineering IV     | -    | -    | -    | 40d  | 45   | 50   | 50   | 50   |
|                                        | Electric Engineering V      | -    | -    | -    | -    | 32   | 38   | 38   | 38   |
|                                        | Mechanical Engineering IV   | -    | -    | -    | 30d  | 35   | 40   | 40   | 40   |
|                                        | Mechanical Engineering V    | -    | -    | -    | -    | 25   | 30   | 30   | 30   |
|                                        | Pulp & Paper Engineering IV | -    | -    | -    | -    | 6    | 6    | 6    | 6    |
|                                        | Pulp & Paper Engineering V  | -    | -    | -    | -    | -    | 5    | 5    | 5    |
|                                        | Sub Total                   | 0    | 0    | 0    | 100d | 203  | 239  | 239  | 239  |
|                                        | Applied Science I           | 40   | 40   | 48   | -    | -    | -    | -    | -    |
|                                        | Applied Science IIA         | -    | -    | -    | -    | -    | -    | -    | -    |
|                                        | Applied Science IIB         | -    | -    | -    | -    | -    | -    | -    | -    |
|                                        | Total Degree                | 40   | 40   | 48   | -    | -    | -    | -    | -    |
|                                        | Total School of Engineering | 145  | 166  | 222  | 401  | 561  | 638  | 638  | 638  |

Notes re Table 1

- a) In 1967-68, 61 students were enrolled in "first year Engineering Technology" (40 + 21). It is assumed that this figure will increase to 85 in the following year.
- b) It is assumed that the expanded offerings will result in more students coming into the programs with a complete Grade 13. They will enter at the second year level.
- c) Second year enrolments will be large because direct entries from Grade 13 will compensate for some of the first year failures.
- d) It is proposed that enrolment be initially restricted to one section in each of three programs. All of the new CAAT's will produce their first graduating class in 1970-71. Graduates with high academic standing (approximately 70% average) will be admitted to year 4 of the degree program. Graduates from Lakehead University, Ryerson and the CAAT's will be eligible for admission.

LAKEHEAD UNIVERSITY  
School of Engineering

Enrolment Prior to 1968

|                                  | <u>1965</u><br><u>1966</u> | <u>1966</u><br><u>1967</u> | <u>1967</u><br><u>1968</u> |
|----------------------------------|----------------------------|----------------------------|----------------------------|
| <u>Diploma Programs</u>          |                            |                            |                            |
| Engineering Technology I         | 42                         | 41                         | 40                         |
| Engineering Technology II        | 24                         | 24                         | 24                         |
| Mining Technology I              | 11                         | 10                         | -                          |
| Mining Technology II             | 8                          | 8                          | 4                          |
| Ryerson Architecture I           | 12                         | 12                         | 16                         |
| Ryerson Engineering Technology I | <u>38</u>                  | <u>38</u>                  | <u>21</u>                  |
| Total Diploma                    | <u>135</u>                 | <u>133</u>                 | <u>105</u>                 |
| <u>Degree Programs</u>           |                            |                            |                            |
| Applied Science I                | 28                         | 29                         | 40                         |
| Applied Science IIA              | -                          | -                          | -                          |
| Applied Science IIB              | -                          | -                          | -                          |
|                                  | <u>28</u>                  | <u>29</u>                  | <u>40</u>                  |
| Total School of Engineering      | <u>163</u>                 | <u>162</u>                 | <u>145</u>                 |

LAKEHEAD UNIVERSITY  
SCHOOL OF ENGINEERING

TABLE II

Summary of Total Faculty for the Period 1965 - 1975

PROGRAM: Degree: 4th & 5th year in Chemical, Civil, Electrical, Mechanical  
Diploma: 3-year programs in Chemical, Civil, Electrical, Mechanical  
1st year Ryerson Architecture

|                                   | <u>1965</u><br><u>1966</u> | <u>1966</u><br><u>1967</u> | <u>1967</u><br><u>1968</u> | <u>1968</u><br><u>1969</u> | <u>1969</u><br><u>1970</u> | <u>1970</u><br><u>1971</u> | <u>1971</u><br><u>1972</u> | <u>1972</u><br><u>1973</u> | <u>1973</u><br><u>1974</u> | <u>1974</u><br><u>1975</u> |
|-----------------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| Engineering Faculty               | 6                          | 6                          | 6                          | 6                          | 8                          | 19                         | 27                         | 27                         | 27                         | 27                         |
| Arts & Science Faculty            | 4                          | 4                          | 4                          | 4                          | 4                          | 8                          | 8                          | 8                          | 8                          | 8                          |
|                                   | —                          | —                          | —                          | —                          | —                          | —                          | —                          | —                          | —                          | —                          |
| Total Engineering, Arts & Science | 10                         | 10                         | 10                         | 10                         | 12                         | 27                         | 35                         | 35                         | 35                         | 35                         |
|                                   | ==                         | ==                         | ==                         | ==                         | ==                         | ==                         | ==                         | ==                         | ==                         | ==                         |

NOTES

- 1) Based on the current system of units used in Arts & Science  
i.e., 1 lecture hour per week for 1 term = 1 unit  
2 laboratory hours per week for 1 term = 1 unit  
18 units = 3 full courses
- 2) Number of Faculty = Number of units divided by 18

SCHOOL OF ENGINEERING  
Analysis of Programs

Table III.

|          |                                               |                               |               |              |               |              |              |                 |              |              |              |              |
|----------|-----------------------------------------------|-------------------------------|---------------|--------------|---------------|--------------|--------------|-----------------|--------------|--------------|--------------|--------------|
| PROGRAM: | Degree (c):                                   | 4th and 5th year              | 1) Electrical | 2) Civil     | 3) Mechanical | 4) Chemical  |              |                 |              |              |              |              |
|          | Diploma:                                      | 3 year programs in            | 1) Electrical | 2) Civil     | 3) Mechanical | 4) Chemical  |              |                 |              |              |              |              |
|          |                                               | 1st year Ryerson Architecture |               |              |               |              |              |                 |              |              |              |              |
|          |                                               |                               | 1965<br>1966  | 1966<br>1967 | 1967<br>1968  | 1968<br>1969 | 1969<br>1970 | 1970<br>1971(c) | 1971<br>1972 | 1972<br>1973 | 1973<br>1974 | 1974<br>1975 |
| 1.       | Total Enrolment, Sch. of Engineering          |                               | 163           | 162          | 145           | 166          | 222          | 401             | 561          | 638          | 638          | 638          |
|          | Diploma                                       |                               | 135           | 133          | 105           | 126          | 174          | 301             | 358          | 399          | 399          | 399          |
|          | Degree                                        |                               | 28            | 29           | 40            | 40           | 48           | 100             | 203          | 239          | 239          | 239          |
| (a) 2.   | Total Units in Engineering Courses            |                               | 104           | 104          | 104           | 104          | 104          | 147             | 340          | 480          | 480          | 480          |
| 3.       | Additional Units in Engineering Courses       |                               | 0             | 0            | 0             | 0            | 43           | 193             | 140          | 0            | 0            | 0            |
| (a) 4.   | Total Units in Arts & Science                 |                               | 65            | 65           | 65            | 65           | 65           | 77              | 135          | 141          | 141          | 141          |
| 5.       | Additional Units in Arts & Science            |                               | 0             | 0            | 0             | 0            | 12           | 58              | 6            | 0            | 0            | 0            |
| (b) 6.   | U.Sch. Faculty for Established Courses        |                               | 5.8           | 5.8          | 5.8           | 5.8          | 5.8          | 8.2             | 18.9         | 26.7         | 26.7         | 27           |
| (b) 7.   | Arts & Sc. Faculty for Established Courses    |                               | 3.6           | 3.6          | 3.6           | 3.6          | 3.6          | 4.3             | 7.5          | 7.9          | 7.9          | 8            |
| (b) 8.   | U.Sch. Faculty for Additional Courses         |                               | 0             | 0            | 0             | 0            | 2.4          | 10.7            | 7.8          | 0            | 0            | 0            |
| (b) 9.   | Arts & Science Faculty for Additional Courses |                               |               |              | 0             | 0            | 0.7          | 3.2             | 0.4          | 0            | 0            | 0            |
| 10.      | Total Faculty, Arts, Science & U. Sch.        |                               | 9.4           | 9.4          | 9.4           | 9.4          | 12.5         | 26.4            | 34.6         | 34.6         | 34.6         | 35           |
| 11.      | Student: Faculty Ratio                        |                               | 17.3/1        | 17.2/1       | 15.4/1        | 17.6/1       | 17.7/1       | 15.2/1          | 16.2/1       | 18.4/1       | 18.4/1       | 18.2/1       |
| 12.      | Number of Income Units                        |                               | 186           | 191          | 185           | 206          | 270          | 501             | 761          | 877          | 877          | 877          |

## LAKEHEAD UNIVERSITY

SCHOOL OF ENGINEERING  
Analysis of Programs

Table III. Page 2

| PROGRAM: | Degree (c):<br>Diploma            | 4th and 5th year<br>3 year programs in<br>1st year Ryerson Architecture | 1) Electrical | 2) Civil    | 3) Mechanical | 4) Chemical    |             |             |             |
|----------|-----------------------------------|-------------------------------------------------------------------------|---------------|-------------|---------------|----------------|-------------|-------------|-------------|
|          |                                   |                                                                         |               |             |               |                |             |             |             |
|          |                                   |                                                                         | 1967          | 1968        | 1969          | 1970           | 1971        | 1972        | 1973        |
|          |                                   |                                                                         | <u>1968</u>   | <u>1969</u> | <u>1970</u>   | <u>1971(c)</u> | <u>1972</u> | <u>1973</u> | <u>1974</u> |
| 1.       | Total Enrolment, Sch. of Eng'ing  |                                                                         | 145           | 166         | 222           | 401            | 561         | 638         | 638         |
|          | Diploma                           |                                                                         | 105           | 126         | 174           | 301            | 358         | 399         | 399         |
|          | Degree                            |                                                                         | 40            | 40          | 48            | 100            | 203         | 239         | 239         |
| (d) 13.  | Basic Income (Formula)            |                                                                         | \$173000      | 206000      | 289000        | 570000         | 928000      | 1150000     | 1230000     |
| (e) 14.  | Emerging Grant Estimate           |                                                                         | \$110000      | 55000       | 28000         | 14000          | --          | --          | --          |
| (f) 15.  | Est. Fees Income                  |                                                                         | \$ 58000      | 68000       | 94000         | 181000         | 278000      | 333000      | 349000      |
| 16.      | Est. Total Income                 |                                                                         | \$341000      | 329000      | 411000        | 765000         | 1206000     | 1483000     | 1579000     |
| 17.      | 60% Income for Instruction        |                                                                         | \$205000      | 197000      | 246000        | 460000         | 724000      | 890000      | 946000      |
| (g) 18.  | School of Engineering Budget Only |                                                                         | \$110000      | 118000      | 168000        | 380000         | 533000      | 570000      | 618000      |
| (h) 19.  | Service Courses Arts & Science    |                                                                         | \$ 42000      | 45000       | 48000         | 62000          | 116000      | 130000      | 138000      |
| 20.      | Total Sch. of Engineering Budget  |                                                                         | \$152000      | 163000      | 216000        | 442000         | 649000      | 700000      | 748000      |
| 21.      | + Surplus                         |                                                                         | +\$53000      | +\$34000    | +\$30000      | +\$18000       | +\$75000    | +\$190000   | +\$198000   |

Page 11(b)

- (a) Based on the current system of units used in Arts & Science  
i.e. 1 lecture hour per week for 1 term = 1 unit  
2 lecture hours per week for 1 term = 1 unit
- (b) Number of Faculty = Number of units divided by 18
- (c) Degree introductory year 1970-1971
- (d)  $\$940 \times 185 \text{ income units} = \$173,000$ ; assumed increase in income unit 7% per annum
- (e) Assumed to decrease at the rate of 50% per annum
- (f) Assumed to increase at 5% per annum
- (g) Assumed to increase at 7% per annum; For 1969-70:  $\$118,000 \times 1.07 \times 12.5/9.4 = \$168,000$
- (h) Increase based on Faculty ratio; for 1969-70:  $3.6/12.5 \times \$168,000 = \$48,000$

LAKEHEAD UNIVERSITY  
SCHOOL OF ENGINEERING

Program Outlines

|                                | <u>Page</u>    | <u>Course</u>      |
|--------------------------------|----------------|--------------------|
|                                | <u>Summary</u> | <u>Description</u> |
| <u>B.A.Sc. Degree Programs</u> |                |                    |
| Chemical Engineering Courses   | 13             | 17                 |
| Civil Engineering Courses      | 14             | 19                 |
| Electrical Engineering Courses | 15             | 22                 |
| Mechanical Engineering Courses | 16             | 25                 |
| Arts & Science Courses         | 17             | 28                 |

LAKEHEAD UNIVERSITYCHEMICAL ENGINEERING DEGREE PROGRAMFOURTH YEAR

|             |       |                                         | <u>LEC.</u> | <u>LAB.</u> |
|-------------|-------|-----------------------------------------|-------------|-------------|
| Physics     | 3e6   | Modern Physics (Selected topics)        | 2           |             |
| Mathematics | 3q6   | Differential Equations                  | 2           |             |
| Mathematics | 3r4   | Applied Statistics                      | 2           |             |
| Chemistry   | 3f6   | Organic Chemistry                       | 2           | 3           |
| Chemistry   | 3h6   | Analytical Chemistry & Instru. Analysis | 2           | 3           |
| Engineering | ChE4c | Process Principles in Unit Operations   | 3           | 3           |
| Engineering | MT3b  | Fluid Mechanics (same as Mech. III)     | 2           |             |
| Engineering | ME4g  | Engineering & Business                  | 1           | 2           |
|             |       | Humanities (elective)                   | 3           |             |
| TOTAL HOURS |       |                                         | 19          | 11          |

FIFTH YEAR

|             |       |                                          |    |    |
|-------------|-------|------------------------------------------|----|----|
| Engineering | ME5a  | Applied Thermodynamics                   | 2  |    |
| Engineering | ChE5a | Computer Analysis & Programming          | 2  |    |
| Engineering | ChE5b | Chemistry of Cellulose & Wood            | 2  | 3x |
| Engineering | ChE5c | Advanced Pulp & Paper Mfg.               | 2  | 3  |
| Engineering | ChE5d | Process Dynamics, Control & Optimization | 2  | 2  |
| Engineering | ChE5e | Economics of Plant Design                | 2  | 2  |
| Engineering | ME5g  | Systems Engineering                      | 2  |    |
| Engineering | ME5h  | Production Management                    | 2  |    |
|             |       | Humanities (elective)                    | 3  |    |
| Engineering | E5a   | Thesis Project                           | 1  | 3y |
| TOTAL HOURS |       |                                          | 20 | 10 |

LAKEHEAD UNIVERSITYCIVIL ENGINEERING DEGREE PROGRAMFOURTH YEAR

|             |      |                                        | <u>LEC.</u> | <u>LAB.</u> |
|-------------|------|----------------------------------------|-------------|-------------|
| Physics     | 3e6  | Modern Physics (selected topics)       | 2           |             |
| Engineering | ME4a | Mechanics of Materials                 | 2           | 0           |
| Engineering | ME4b | Materials Science                      | 2x          |             |
| Mathematics | 3p4  | Applied Mathematics                    | 2           |             |
| Engineering | CE4a | Matrix Analysis & Computer Application | 2y          |             |
| Engineering | EE4a | Electrical Engineering I               | 2           | 3           |
| Engineering | MT2a | Thermodynamics I                       | 2           |             |
| Engineering | CE4b | Math. Theory of Elasticity             | 3           |             |
| Engineering | CE4c | Surveying                              | 2           |             |
| Engineering | CE4d | Laboratory                             |             | 3           |
| Engineering | ME4g | Engineering & Business                 | 1           | 2           |
|             |      | Humanities (elective)                  | 3           |             |

## TOTAL HOURS

21      8

FIFTH YEAR

|             |      |                                              |    |    |
|-------------|------|----------------------------------------------|----|----|
| Engineering | CE5a | Hydraulic Engineering                        | 2  |    |
| Engineering | CE5b | Soil Mechanics & Foundation Design           | 3x |    |
| Engineering | CE5c | Structural Analysis                          | 3  |    |
| Engineering | CE5d | Structural Design                            | 2  | 3  |
| Engineering | CE5e | Reinforced Concrete Design                   | 2  | 3y |
| Engineering | CE5f | Municipal Planning, Administration & Transp. | 2  |    |
| Engineering | CE5g | Traffic & Transp. Engineering                | 2  |    |
| Engineering | CE5h | Civil Eng. Laboratory                        |    | 3  |
|             |      | Humanities (elective)                        | 3  |    |
| Engineering | E5a  | Thesis Project                               | 2  | 2y |

## TOTAL HOURS

21x      6x  
18y      11y

LAKEHEAD UNIVERSITYELECTRICAL ENGINEERING DEGREE PROGRAMFOURTH YEAR

|             |      |                                  | <u>LEC.</u> | <u>LAB.</u> |
|-------------|------|----------------------------------|-------------|-------------|
| Physics     | 3e6  | Modern Physics (selected topics) | 2           |             |
| Engineering | ME4a | Mechanics of Materials           | 2           | 3           |
| Engineering | ME4b | Materials Science                | 2           |             |
| Mathematics | 3p4  | Applied Mathematics              | 2           |             |
| Mathematics | 3q6  | Differential Equations           | 2           | 2           |
| Engineering | EE4c | Electrical Engineering I         | 2           | 3           |
| Engineering | EE4d | Electronics                      | 2           | 3           |
| Engineering | ME4g | Engineering & Business           | 1           |             |
|             |      | Humanities (elective)            | 3           |             |
| TOTAL HOURS |      |                                  | 18          | 11          |

FIFTH YEAR

|             |      |                                   |    |    |
|-------------|------|-----------------------------------|----|----|
| Mathematics | 4p4  | Advanced Mathematics              | 2  |    |
| Engineering | EE5a | Electronics                       | 3  |    |
| Engineering | EE5b | Electrical Engineering II         | 2  | 3  |
| Engineering | EE5c | Communications Systems            | 2  |    |
| Engineering | EE5d | Control Systems                   | 2  | 3  |
| Engineering | EE5e | Electrical Engineering Laboratory |    | 6  |
| Engineering | ME5h | Production Management             | 2  |    |
|             |      | Humanities (elective)             | 3  |    |
| Engineering | E5a  | Thesis Project                    |    | 2  |
| TOTAL HOURS |      |                                   | 16 | 14 |

LAKEHEAD UNIVERSITYMECHANICAL ENGINEERING DEGREE PROGRAMFOURTH YEAR

|             |      |                                  | <u>LEC.</u> | <u>LAB.</u> |
|-------------|------|----------------------------------|-------------|-------------|
| Physics     | 3e6  | Modern Physics (selected topics) | 2           |             |
| Engineering | ME4a | Mechanics of Materials           | 2           | 3           |
| Engineering | ME4b | Materials Science                | 2           |             |
| Mathematics | 3p4  | Applied Mathematics              | 2           |             |
| Mathematics | 3q6  | Differential Equations           | 2           | 2           |
| Engineering | EE4a | Electrical Engineering I         | 2           | 3           |
| Engineering | EE4b | Experimental Electronics         | 1           | 2           |
| Engineering | ME4g | Engineering & Business           | 1           | 2           |
|             |      | Humanities (elective)            | 3           |             |
| TOTAL HOURS |      |                                  | 17          | 12          |

FIFTH YEAR

|             |      |                                   |    |    |
|-------------|------|-----------------------------------|----|----|
| Engineering | ME5a | Applied Thermodynamics            | 2  |    |
| Engineering | ME5b | Heat Transfer                     | 2  |    |
| Engineering | ME5c | Fluid Mechanics                   | 2  |    |
| Engineering | ME5d | Mechanical Analysis               | 2  | 3  |
| Engineering | ME5e | Eng. Design (Computer Appl.)      | 2  | 2  |
| Engineering | ME5f | Mechanical Engineering Laboratory |    | 6  |
| Engineering | ME5g | Systems Engineering               | 2  |    |
| Engineering | ME5h | Production Management             | 2  |    |
|             |      | Humanities (elective)             | 3  |    |
| Engineering | E5a  | Thesis Project                    |    | 2  |
| TOTAL HOURS |      |                                   | 17 | 13 |

LAKEHEAD UNIVERSITY SCHOOL OF ENGINEERING

C O U R S E S

The following courses are offered for the Engineering Degree programs.  
(Prerequisite: Diploma in Engineering Technology with 70% average.)

CHEMICAL ENGINEERING DEGREE COURSES (Pulp and Paper)

Engineering ChE4a - Process Principles in Unit Operations

Calculations and concepts of unit operations associated with fluid dynamics, chemical energy, materials balance and heat transfer; specific emphasis in the areas of evaporation, filtration, humidification, drying, and chemical recovery methods and equipment.

Engineering ChE5a - Computer Analysis & Programming

Computer programming and the application of the computer in data analysis and process control.

Engineering ChE5b - Chemistry of Cellulose & Wood

Chemistry of wood, pulp and pulping by-products covering: wood composition, cellulose, lignin, hemicellulose, extractives, spent liquor utilization, bleaching mechanisms and reactions, effect of chemical treatment on optical and strength properties of paper.

Engineering ChE5c - Advanced Pulp & Paper Manufacture

Continuation of topics introduced in earlier courses. Lecture and laboratory time is devoted to theory, engineering practice involving process techniques, pulping equipment, chemical recovery, by-products, bleaching, fiber preparation, formation and water removal from paper, slime control, stream and air pollution.

Engineering ChE5d - Process Dynamics, Control & Optimization

Analysis of the dynamics of simple process units and systems; mathematics of process dynamics and control including differential equations and transform techniques; control loop imperfections - hysteresis lag and deadtime; applications to stability; control, instrumentation and optimization of such processes.

Engineering ChE5e - Economics of Plant Design

Plant location; plant and process design, operation and optimization; systems approach; over-all plant integration. Students will submit design proposals of equipment and plants pertaining to the various aspects of pulp and paper industry.

CIVIL ENGINEERING DEGREE COURSES

Engineering CE4a - Matrix Analysis & Computer Applications

Application to structural analysis; Matrix multiplication, inversion, transposition, properties of matrices.

Engineering CE4b - Mathematical Theory of Elasticity

Stress-strain relationships and analysis in two and three dimensions; thermal effects; variation principles; parametric expansion methods; linear and non linear theory of beams, plates and shells.

Engineering CE4c - Surveying

Control surveys; triangulation; geodetic field surveying; base line measurements; computation of geodetic positions; astronomical determinations; map projection photogrammetry.

Engineering CE4d - Laboratory

Laboratory applications of principles covered in Surveying, Electrical Engineering, Thermodynamics and Mechanics of Materials.

Engineering CE5a - Hydraulic Engineering

Application of fluid mechanics to civil engineering problems: flow in pipes and open channels, surge tanks, water hammer, pumps, turbines, hydrology. Principles of design, operation and field investigation of hydraulic mechanisms.

Engineering CE5b - Soil Mechanics & Foundation Design

Foundation investigation; bearing capacity of soils; footing design; raft pile, pier and other foundations; settlement studies; excavation and underpinning; theories of vertical and lateral soil pressures; hydrostatic uplift and seepage; retaining walls and abutments; stability of embankments; unusual foundation considerations.

Engineering CE5c - Structural Analysis

A comprehensive study of indeterminate systems by deflection methods, least work, three moment theorem. Slope deflection, moment distribution, column analogy. Introduction to computer methods in solid mechanics.

Engineering CE5d - Structural Design

Non-homogeneous beams; plate girders; plastic design; bridge design.

Engineering CE5e - Reinforced Concrete Design

Continuous beams and frames; prestressed concrete; retaining walls; arch and shell roofs; concrete bridges.

Engineering CE5f - Municipal Planning, Administration & Transportation

Contemporary concepts in town and regional planning and their theoretical, practical and legal applications; organization of municipal government, finance, legislation; the role of the municipal engineer and consultant in public works; provision of municipal services; growth of regions as affected by transportation; co-ordination of transportation with land use.

Engineering CE5g - Traffic & Transportation Engineering

Urban transportation planning; methods of project evaluation; theory of traffic flow; characteristics of traffic flow and traffic control at intersections; transportation systems: highway, railroad, shipping, pipelines, conveyors, airports; structural design of pavements.

Engineering CE5h - Civil Engineering Laboratory

Soils and foundations; hydraulics; sanitary engineering.

ELECTRICAL ENGINEERING DEGREE COURSES

Engineering EE4a - Electrical Engineering I

Review of 2 and 3 terminal network analysis. Matrix methods applied to network analysis. Transmission line theory. Fourier series and integrals and application to complex waveform analysis. The laplace transformation. Response of circuits to pulses and transients. Electromechanical energy conversion: commutator machines; induction and synchronous machines; 3-phase machines; the transformer; the saturable reactor electronic control of machines; servomechanisms. Introduction to power distribution systems.

Engineering EE4b - Experimental Electronics

Electrical measurements; electronic components, instruments, circuits; experimental techniques.

Engineering EE4c - Electrical Engineering I

Electromechanical energy conversion; DC and AC machines; servo motors; generalized rotating machine; transformers; transducers; machine networks.

Engineering EE4d - Electronics

Semiconductor physics; semiconductor/insulator surfaces and interfaces; contact phenomena. Theory and practical design features of electron devices: p.n. junction diodes; varactors; zener diodes; unipolar and bipolar transistors; thyristors; Hall effect multiplier. Microwave Solid State Devices: Gunn oscillator; Silicon Avalanche diode; Schottky barrier diode.

Engineering EE5a - Electronics

Analysis and design of amplifiers, oscillators, detectors, modulators, wave shaping circuits; electro acoustical transducers; noise in electronic circuits; logic circuits; computer memory systems. Physics and fabrication of semiconductor integrated circuits; design of digital and linear integrated circuits. Physics of thin and thick films and application to microelectronics. Introduction to computer aided design of microcircuits.

Engineering EE5b - Electrical Engineering II

Passive and active filter design. Circuits with distributed constants. Electromagnetic field theory; Maxwell's equations; radiation; reflection and refraction; Power density and the Poynting Vector. Wave propagation in conducting media. Charged particles in electromagnetic fields. Microwave tubes. Electron beam devices. Application of the theory of the complex variable to solution of field problems. Introduction to network synthesis.

Engineering EE5c - Communication Systems

Modulation theory and noise. Phase sensitive detectors. Parametric amplifiers. Multiplex methods. Pulse code modulation. Line, radio, and microwave communications systems and equipment. Introduction to information theory and coding.

Engineering EE5d - Control Systems

Feedback control systems analysis; stability, gain, compensation; design of linear control systems; introduction to non linear systems.

Engineering EE5e - Electrical Engineering Laboratory

Laboratory for EE5a, EE5b, EE5c, EE5d.

MECHANICAL ENGINEERING DEGREE COURSES

Engineering ME4a - Mechanics of Materials

Statistical mechanical analysis; stress distribution; struts; failure; bending theory; strain energy; solids and fluids tensor notation.

Engineering ME4b - Materials Science

Physical, mechanical, chemical properties of metallic, ionic, polymeric materials; correlation of properties with crystal and microstructure; quantitative metallography. Crystal imperfections. Diffusion. Metallic solutions and compounds; phase diagrams. Dislocations.

Engineering ME4g - Engineering & Business

Engineering and business planning, organizing, directing, staffing, controlling and assembling resources; modern planning techniques; business, labour and law seminars.

Engineering ME5a - Applied Thermodynamics

Steady and unsteady bulk flow; turbines, compressors, heat exchangers; power generation, refrigeration cycles. Kinetic theory of rate processes.

Engineering ME5b - Heat Transfer

Conduction, convection, radiation; industrial processes and nuclear energy conversion; boiling, condensation organic liquids and liquid metals; vapour state energy conversion and transmission.

Engineering ME5c - Fluid Mechanics

Compressible and incompressible fluid dynamics; conservation of mass momentum and energy; stress-strain relations; Navier-Stokes equations; potential flow; similitude, creeping flow, porous media flow, boundary layers; flow and energy dissipation in uniform conduits internal aerodynamics; fluid machinery; external aerodynamics.

Engineering ME5d - Mechanical Analysis

Selection and design of machines and components; vibration and noise; design synthesis; application of experimental stress analysis; structural similitude and modeling.

Engineering ME5e - Engineering Design

Creative design and design analysis; system approach; competitive alternatives; student presentations of formal proposals.

Engineering ME5f - Mechanical Engineering Laboratory

Experiments and projects for ME5a, ME5b, ME5c, ME5d, ME5h showing relation between analytical and experimental methods in the solution of research and development problems; computer applications.

Engineering ME5g - Systems Engineering

Dynamic modeling; unified treatment of active and passive mechanical, fluid, thermal, electrical and electronic systems and devices. Examples from chemical, electrical, civil, mechanical, aeronautical and business.

Engineering ME5h - Production Management

Operations research; mathematics for management; sales, financial, and production systems; planning and control techniques; input output analysis

The following courses are offered for the Engineering Degree programs by Departments of Arts and Science.

Mathematics 3k6 - Differential Equations

Linear algebra, linear differential equations with constant coefficients, geometry of solutions, non-linear equations, phase plane, linear systems with variable coefficients, series solutions, numerical computation and computer programming.

Mathematics 3p4 - Applied Mathematics

Vectors, vector calculus, vector operations and fields with applications in classical mechanics; rotational motion and central forces, orbital motion; introduction to tensors with applications in continuum mechanics and elasticity.

Mathematics 3r4 - Applied Statistics

A review of statistics - tests of hypothesis, sampling, regression analysis, analysis of variance. Experimental methods of design, complete and incomplete factorial and block design, response surface techniques of optimization. Applied portion of course to pertain to the analysis of quality control and engineering data.

Mathematics 4p4 - Advanced Mathematics

An advanced course in mathematics for electrical engineers. To include Probability Theory. Theory of Complex Variable.

Physics 3e6 - Modern Physics

Atomic and nuclear physics illustrating principles of quantum mechanics. To include: Band theory of solids, and elements of crystallography; particle statistics; Brillouin zones and E/k diagrams; effective mass of electrons and holes. Transport properties of metals: electrical and thermal conductivities; Hall effect; thermoelectric effects; superconductivity. Electron/phonon interaction in solids. Optical properties of semiconductors. Electromagnetic interactions: masers and lasers. Resonances in solids. Magnetic and dielectric properties of solids.

Chemistry 3f6 - Organic Chemistry

Classification and nomenclature of simple organic compounds; nature of covalent bond; resonance; stereo-chemistry. The general reactions and the reaction mechanisms of addition, substitution and elimination. Laboratory preparation and purification of organic compounds.

Chemistry 3h6 - Analytical Chemistry and Instrumental Analysis

The theory of gravimetric, volumetric and instrumental analysis. Analytical methods as applied to the field of organic and inorganic chemistry. Special and advanced applications to Pulp and Paper.

Appendix A

Lakehead University

School of Engineering: Diploma/Degree Program Features

- 1) Operation of Engineering Technology Diploma and Engineering Degree academic programs in series will improve the long term relationship between technologists and engineers by increasing the understanding of the role and function of each relative to one another.
- 2) Provides a practical method for Engineering Technology diploma graduates to stay in Canada to complete the requirements for an engineering degree within a time frame acceptable and encouraging to the serious student.
- 3) Applies the concept of the extended cooperative program. After only 3 years of technical study a student is qualified as a technologist to spend an extended period of time in the industry and return to complete the Engineering degree requirements. Not all students would choose this option, however; students who must fund their own education would benefit.
- 4) The concept of the industry standard and modernization can be incorporated in the laboratory design and curriculum. In addition, the maximum possible use can be made of secondary industry facilities in the Lakehead which may help to establish a mutually attractive and active applied research and technology applications program. This would lead, in the long term, to high retention of graduates in the Lakehead area and provide assistance and encouragement to the more rapid development of secondary industry in the Lakehead.
- 5) Summer session short courses for Industry and Government in applications technology and applied research seminars can be developed to utilize School of Engineering resources and capabilities.
- 6) The diploma/degree program in engineering will operate effectively on the system of formula financing which is now in use in the Province of Ontario.

## LAKEHEAD UNIVERSITY

## SCHOOL OF ENGINEERING

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