FIRE SCIENCE TECHNOLOGY CURRICULUM STUDY

FOR WICHITA STATE UNIVERSITY

By

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CHAPTER I

THE RESEARCH PROBLEM

Background

The Fire Science program at Wichita State University is housed within the Engineering Technology Department in the College of Engineering. The existing Fire Science program developed from a twenty-four hour certificate program which began in the Fall semester of 1972. The certificate program provides local fire-fighters the opportunity to take post high school courses in the fire science field. The four-year Fire Science Technology option was developed in 1975 as part of a four-year option Engineering Technology degree. The four options of the Engineering Technology degree are Electrical, Manufacturing, Mechanical, and Fire Science. The Engineering Technology degree was implemented in an effort to provide a technical four-year degree graduate that could meet the practical needs of employers.

There are 16 bachelor degree programs in Fire Science available in the United States. However, a shortage of technical fire science specialists with degrees exists because only five of these institutions offer a technical based bachelors degree in this field. The schools are: Maryland University at College Park, Maryland, Illinois Institute of Technology at Chicago, Illinois, Oklahoma State University at Stillwater, Oklahoma, University of Cincinnati at Cincinnati, Ohio, and

Wichita State University at Wichita, Kansas. Graduates from these universities find employment in industry, government, insurance, fire protection equipment design and sales, municipal fire service, and education. The career goals of the graduates can be divided into two categories: fire service related careers and industrial related careers.

In an effort to provide graduates for the two major areas of employment, the specialty courses have often been spread very thin, and offer little chance for students to become engaged in serious study of the fire service or industrial fire science.

The existing Fire Science Technology curriculum (see Appendix) at Wichita State University contains 69 credit hours of required technical courses. The distribution of these hours are as follows:

(a) sixteen credit hours of Technology core courses,

(b) forty-five credit hours of required specialty courses (Six of these hours are non-fire science courses.), and

(c) eight credit hours of technical electives.

As can be seen, the program is restrictive for the students in their selection of technical courses. If an individual is interested in being employed by an industrial firm, he must still enroll in Fire Fighting Tactics and Strategy, Emergency Rescue and Procedures, and other technical courses not related to his employment goals. Conversely, an individual seeking an administrative position in the fire service must enroll in equally non-career related specialty courses.

Another negative aspect of the current curriculum is that the content of the fire science courses were not evaluated when the courses were

incorporated into an Engineering Technology option. The only fire science adviser for the degree, during the change over period, was a Fire Chief from the Wichita Fire Department. This led to the courses that were specifically designed for the benefit of the local fire service and are not being used to prepare graduates for broader fire service and industrial positions.

Statement of the Problem

The existing Fire Science curriculum is relatively inflexible and offers limited opportunities for students to become seriously involved in courses that will most directly benefit their career goals.

Purpose of the Study

The purpose of the study was to develop a Fire Science curriculum for the Engineering Technology Department at Wichita State University. The curriculum should prepare students for industrial or fire service career positions.

Assumptions

For the purposes of this study, the following assumptions were accepted by the investigator:

1. The selected distribution of the participants would provide the information necessary to accomplish the objectives of the study.
2. The information gathered was appropriate for curriculum planning.

Limitations

The following limitations apply to the study:

1. There was an unequal distribution of experts responding from the four areas of interest.
2. The amount of bias injected into the results by the investigator and the respondents.
3. No distinction can be made between reasonable judgement and guessing by the respondents.
4. Implication of this study may not be applicable to fire science programs not having the same goals and constraints as those of Wichita State University.
5. The following constraints are placed on the curriculum by the Engineering Technology Department on Wichita State University.
    a. A minimum of 124 credit hours must be completed for graduation.
    b. Twenty-six credit hours of mathematics and basic science.
    c. Sixteen credit hours of humanities and fine arts and social and behavioral sciences (8 hours must be general studies courses).
    d. Nine credit hours of communication courses.
    e. Four credit hours of free electives.
    f. A minimum of sixteen credit hours of general technology core courses.

g. A total of forty semester credit hours must be in 300 level and above courses.

h. The curriculum must be able to meet the requirements for Accrediation by the Engineering Council for Professional Development (ECPD).

Objectives of the Study

The objectives of the study were to:

1. Identify which Fire Science courses best fit the Fire Science Technology core requirement section.
2. Identify which Fire Science Technology courses best fit in the Fire Science elective section.
3. Identify any non-Fire Science Technology courses that should be included in the curriculum (elective or non-elective).
4. Identify an appropriate chemistry and physics sequence for Fire Science Technology.
5. Examine present Fire Science Technology course major topics as to their value to the Fire Science graduate upon employment.
6. Incorporate the results derived from the study with the general education courses, the technology core courses and the mathematics and science requirements into a Fire Science curriculum.

Definition of Terms

The following definitions are used in a particular context or a specific meaning for the study:

1. Core requirement - That group of courses which all engineering technology students are required to successfully complete.

2. Engineering - Any technical field of study concentrating on the theoretical aspects of the sciences and has calculus for a beginning point in mathematics.

3. Engineering Technology - Any technical field of study concentrating on application of the aspects of the sciences and has college algebra for a beginning point in mathematics.

4. Fire Science - Used to encompass all aspects of Fire Science, such as, prevention, detection, protection, and/or suppression.

5. Fire Science core requirements - That group of courses which all fire science students are required to successfully complete.

6. Fire Science elective section - That group of courses from which all fire science students are required to select in order to complete the technical elective requirements.

7. Fire Service profession - Any position which has as a main job function the control and extinguishing of fires and the supervision of such functions.

8. Industrial profession - Any position not within the realm of the fire service. This includes; insurance, petroleum, design, maintenance, or technical sales.

9. Part I crime - Will carry the highest penalty available under the law.

Summary

In summary, the existing curriculum at Wichita State University can

be improved by an examination as to how effectively it benefits students career goals. The curriculum should be designed so students can concentrate their efforts in a selected area of interest.

CHAPTER II

REVIEW OF LITERATURE

Rationale for the Problem

Fire is a national problem. Annually fire claims nearly 12,000 lives and injures over 300,000 people in the United States. Of these, nearly 50,000 are confined to a hospital for six weeks to two years (13). The property damage estimate for 1978 is 13.6 billion dollars (17).

It is information such as this that supports the growing belief that a solution to the problem is to be found in a greater emphasis for fire prevention and education of qualified fire science specialists. As stated by Andrew Pryor, Fire Protection Engineer for the United States Energy Research and Development Administration, "A lack of qualified, experienced, fire protection staffing contributed to the conditions which resulted in a direct loss of $10 million and an indirect loss of $30 million when fire occurred at the Brown's Ferry Installation" (15 p. 23).

This lack of fire science knowledge is also felt outside of private industry. A report in the May 9, 1977, Milwaukee Journal (11) presented an example of the need for a better utilization of fire science knowledge. According to the report, in 1973, the Milwaukee City Council adopted an ordinance requiring automatic sprinkler systems be installed in buildings. However, 41 out of 56 appeals were granted, exempting certain buildings

from the sprinkler requirement. Listed among the structures, which were allowed to install smoke detectors in lieu of sprinklers, were 13 day care centers, one of which subsequently burned killing two children.

This is a typical example of the frustration experienced by public officials attempting to make decisions concerning public safety. The fire science specialist would appear to be in a position to help improve the fire protection of a community. Milwaukee did not utilize a fire science specialist in their appeals procedure. The specialist could be utilized in the fire prevention bureau, in consultation with designers and builders, in urban planning, and in advising for fire protection ordinances. A number of cities, such as Los Angeles, San Jose, and Dayton, already employ a fire protection specialist. However, a number of other city officials have been unable to employ specialists because of the small number of graduates per year (1).

Education is also an important benefit to the fire-fighter. Fire-fighting is becoming more complex everyday, and education must keep pace. "The need for education in the fire science begins with the fire-fighter's need to better understand the behavior of fire and new materials, chemicals, and other sources of combustion and fuel that arise in a fire situation" (12). This need is more than a desire of the individual to become better educated. Several states have now adopted minimum performance standards for fire-fighters. These standards will require the fire-fighter to pass written examinations and demonstrate specific skills with various pieces of equipment. Educational programs will be needed to develop and teach the information needed for certification (17).

Another area that has produced a profound effect upon the educational needs of a fire science specialist is the arson problem.

This importance can do nothing but increase since arson has been reclassified as a part I crime in the Uniform Crime Reporting Program. "The fire service must be fully informed of the impact of reclassification and must be prepared to ensure that an effective arson program exists in every jurisdiction, regardless of size and the mechanics of the program" (4). The key word in the preceding statement is effective. It creates a difficult education problem when it has been estimated by Jack Schrader, Arson Instructor for the National Fire Academy, that there are no more than 50 effective arson squads in the country (16).

Delphi Technique

The Delphi Technique was used as the data collection device for this study. The Delphi Techniques was developed as a long-range forecasting tool by the Rand Corporation (8).

> The experiment was designed to apply expert opinion to the selection, from the viewpoint of a Soviet strategic planner, of an optimal U. S. industrial target system and to the estimation of the number of A bombs required to reduce the munitions output by a prescribed amount (5, p. 458).

In the past, a method of planning has been by group opinion, usually in a meeting. Unfortunately, this can lead to a compromise solution because of the psychological factors which are a part of a group. At times, this means that the loudest member can influence the group plus the bandwagon effect of majority opinion cannot be discounted.

Other negative characteristics can be the time and expense involved in bringing together the participants. The Delphi Technique counteracts these tradtional effects of a group. To gain the full benefits of a Delphi Technique, the anonymity of the group must be kept.

The Delphi Technique involves the selection of a panel of experts. Brown (3) identifies status among peers, years of professional service, a degree of relative competence of the individual as important characteristics to consider when selecting participants. Each of the participants are asked to respond to specific questions. The responses are tabulated and presented to the participants for their review. At this time, the participants have the opportunity to again answer the questions. Some respondents may elect to change their first response while others will not. The responses can then be tabulated for resubmittal or the results can be formulated. The process is normally followed until the findings have been placed in a priority ranking (10).

The reliability of the Delphi Technique has proven to be as good and in some relationships, better than the advisory committee (6). In DeGuglielmo's study, the Delphi groups generated more items than did the expert control groups. This suggests that the Delphi process is a means of gaining more items on a response. It was also revealed in DeGuglielmo's study that a panel of judges determined that twenty-seven of the thirty-five Delphi produced items carried a relationship with the items generated by the advisory committee.

The use of a group of experts has been a common practice when seeking opinions (14). However, a difference of opinion may arise when determining a sufficient number of experts to include in your study. While some studies have included in excess of one hundred participants, other studies have included far few (2). A number of successful studies have been completed with fewer than fifteen participants (14), while the Rand Corporation has conducted successful studies using

twenty-three participants (3). A survey of other studies revealed a participant range of between ten and twelve. Based on these surveys, it has been determined that twenty participants is adequate for this study.

Results of Previous Studies

Numerous task studies have been completed on the fire service. While this is an excellent method of determining what an individual does on the job, it requires an extremely large sample to be effective. Lisack's (9) study identifies the task of a fire-fighter in great detail. While the results are beneficial to the fire service, the scope is too narrow for this study since it is limited to fire-fighters.

The most popular method of curriculum development for the existing fire related programs has been a local advisory board. All fifteen institutions contacted during the study indicated an advisory board was primarily responsible for the content of their curriculum. However, one must realize that the advisory boards must stay within the constraints set by the universities.

To obtain a clear picture of the existing programs, the institutions offering a bachelors degree in a fire related area were surveyed. The following programs were identified as administration in their orientation.

A. Administration of Safety and Security Services, Jersey City State College.

B. Independent Study, University of Minnesota.

C. Fire Administration and Fire Technology, University of New Haven.

D. Fire Science and Fire Service Administration, John Jay College of Criminal Justice.

E. Public Service - Fire Science, Boston State College.

F. Industrial and Technical Education for Fire Administration, University of South Florida.

G. Fire Protection Administration, California State University of Los Angeles.

H. Forest Fire Science, Humbolt State University.

These programs have in excess of fifty-two percent of their fire science courses with administration orientation. If the business administration courses are considered, the percentage rises to sixty-two. This percentage does not reflect the general education requirements.

The following programs were identified as Technical in their orientation:

A. Fire Protection Engineering, Maryland University.

B. Fire Protection and Safety Engineering, Illinois Institute of Technology.

C. Fire Protection and Safety Engineering Technology, Oklahoma State University.

D. Fire and Industrial Safety Technology, University of Cincinnati.

E. Bachelor of Engineering Technology - Fire Science Option, Wichita State University.

These programs have in excess of seventy percent of their fire science courses with technical orientation. If the non-fire science technical courses are considered, the percentage rises to seventy-five. These percentages do not reflect the general education courses.

The following programs were identified as having a fairly equal distribution of courses in administration and technical area:

A. Fire Protection and Occupational Safety, Madonna College.

B. Public Service - Fire Service, Central Missouri State University.

C. Fire Prevention and Control, Eastern Kentucky University.

These programs allow some degree of flexibility with their programs. Students may elect the technical or administration orientation for their plan of study.

CHAPTER III

METHOLOGY

Introduction

The purpose of the study was to develop a Fire Science curriculum for the Engineering Technology Department at Wichita State University. Chapter III will identify the methology used in the study.

Data Collection System

The data gathering system was a modification of the Delphi Technique. This technique was selected because of its positive characteristics as explained in Chapter II. The system will consist of a mailout survey (see Appendix) with the follow-up being accomplished by interview.

The design of the questionnaire was of great importance to the success of the study. It was designed for easy completion, in a minimum of time. For this reason, the course topics were listed by course titles and numbers. This was also designed to encourage a high rate of return. Instructions were kept as clear and concise as possible.

The information gathered from the seventeen respondents from the first round was organized in table form and mailed back to the respondents. At this time, they were encouraged to review their responses and indicate any changes to their first response.

The second round of responses were gathered by interview. The interview was selected because of the time factor and it allows the investigator to gain points of clarification and, thus, reduce the amount of bias interjected into the study. The data was then tabulated for entry into the paper.

Participant Selection

As previously mentioned in this study, participant selection is of great importance. The participants were selected according to the following criteria:

A. They must currently be involved in the fire science area.

B. They must have completed some post-high school courses and preferably hold a bachelors degree. This was considered desirable because the participants should have some concepts as to the type of material that is contained in a college level course.

C. The participant group should contain one student presently enrolled in the Wichita State University program and one graduate of the program. The group should also consist of representatives from firms that consistently hire fire science graduates.

D. The distribution of the participants shall reflect the following interests:

    1. Five respondents with an insurance background.

    2. Five respondents with an industrial background.

3. Five respondents with a fire service background.
4. Five respondents with government or educational background.

It was felt that the distribution of interest groups should be kept as equal as possible. The previously listed groups were selected because the majority of the fire science specialists are hired by these groups. The total number of participants was kept to twenty so the data would be manageable.

The data for this study was collected during the first three months of 1979.

CHAPTER IV

ANALYSIS OF THE DATA

Introduction

The purpose of the study was to develop a practical Fire Science curriculum for the Engineering Technology Department af Wichita State University. Chapter IV contains the data that was obtained as a result of the study. This data was analyzed by employment category and combined categories.

Description of Participants

The participants were selected based on the criteria set forth in Chapter III. The following fire science professionals were selected by the investigator to serve as participants for the study:

A. Participants selected with insurance background

1. Career Coordinator, Factory Mutual Engineering, St. Louis, Missouri.
2. Loss Prevention Manager, Royal-Globe Insurance Companies, Overland Park, Kansas.
3. Loss Prevention Manager, Liberty Mutual Insurance Company, Oklahoma City, Oklahoma.
4. Engineer-In-Charge, Industrial Risk Insurance, Kansas City, Kansas.

5. Loss Control Engineer, Hartford Insurance Company, Wichita, Kansas.

B. Participants selected with industrial background

1. Fire Protection Engineer, Getty Oil Company, El Dorado, Kansas.
2. Vice President, McDaniel Company, Inc., Wichita, Kansas.
3. Fire Protection Engineer, Vulcan Chemical Company, Wichita, Kansas.
4. Fire Protection Engineer, Continental Oil Company, Severna Park, Maryland.
5. District Manager, Notifier Company, Lincoln, Nebraska.

C. Participants selected with Government or education background

1. State Fire Marshall, Nashville, Tennessee.
2. Assistant Professor, Fire and Safety Department, Oklahoma State University, Stillwater, Oklahoma.
3. Fire Science Director, Johnson County Community College, Overland Park, Kansas.
4. Fire Protection Specialist, Tennessee State Fire Marshall's Office, Nashville, Tennessee.
5. State Chief of Fire Protection, Nashville, Tennessee.

D. Participants selected with fire service

1. Lieutenant, Wichita Fire Department, Wichita, Kansas.
2. Captain, Overland Park Fire Department, Overland Park, Kansas.
3. Fire Chief, Salina Fire Department, Salina, Kansas.

4. Fire Fighter/Emergency Medical Technician, Wichita Fire Department, Wichita, Kansas.
5. Fire Chief, Los Angeles Fire Department, Los Angeles, California.

Data Analysis

The data has been tabulated from responses gathered from the data collection system. Responses for the selection of required and elective fire science courses are contained in Table I.

TABLE I

THE PARTICIPANTS SELECTION FOR REQUIRED AND ELECTIVE FIRE SCIENCE COURSES
(17 RESPONDENTS)

Fire Science Courses	Respondents Selections for Required Courses					Respondents Selections for Elective Courses				
	Ins.[1]	Ind.[2]	Govrt.[3]	F.S.[4]	Total[5]	Ins.	Ind.	Govrt.	F.S.	Total
Industrial Fire Safety, FST 132	5*(5)**	4(4)	3(2)	1(1)	13(12)	0(0)	0(0)	2(3)	1(1)	3(4)
Construction Methods & Materials, FST 133	4(5)	3(3)	4(5)	2(3)	13(16)	1(0)	0(0)	1(0)	0(0)	2(0)
Detection & Suppression Systems, FST 134	4(5)	4(4)	4(4)	2(2)	14(15)	1(0)	0(0)	1(1)	1(1)	3(2)
Fundamentals of Fire Prevention, FST 135	3(3)	2(2)	3(4)	2(3)	10(12)	2(2)	2(2)	2(1)	1(0)	7(5)
Fire Protection Management, FST 202	1(1)	0(0)	3(3)	2(2)	6(6)	2(2)	3(0)	0(0)	1(1)	6(6)
Fire Hydraulics, FST 301	4(4)	4(4)	4(4)	1(1)	13(13)	0(0)	0(0)	0(0)	2(2)	2(2)
Tactics and Strategy, FST 302	1(1)	0(0)	1(1)	1(1)	3(3)	2(2)	3(2)	2(2)	2(2)	9(8)
Water Supplied Systems, FST 303	5(5)	4(4)	3(3)	3(3)	15(15)	0(0)	0(0)	2(2)	1(1)	3(3)
Hazardous Materials, FST 310	4(5)	2(3)	4(4)	3(3)	13(15)	1(0)	1(0)	1(1)	1(1)	4(2)
Fire Investigation, FST 311	2(2)	0(0)	0(2)	2(3)	4(7)	0(0)	3(4)	5(3)	1(1)	9(8)
Rescue Procedures and Practices, FST 350	0(6)	0(0)	1(1)	0(0)	1(1)	2(1)	2(2)	0(0)	1(1)	5(4)

TABLE I (Continued)

Fire Science Courses	Respondents Selections for Required Courses					Respondents Selections for Elective Courses				
	Ins.[1]	Ind.[2]	Govrt.[3]	F.S.[4]	Total[5]	Ins.	Ind.	Govrt.	F.S.	Total
Special Topics Course, FST 422	0(0)	0(0)	0(0)	0(0)	0(0)	3(3)	2(2)	0(0)	0(0)	8(19)
Urban Fire Protection, FST 484	0(0)	0(0)	2(2)	1(1)	3(3)	3(3)	2(2)	3(3)	2(2)	10(10)
Risk Management, FST 492	1(1)	2(2)	1(1)	2(2)	6(6)	4(4)	1(1)	4(4)	2(2)	11(11)
Senior Projects, FST 498	0(0)	1(1)	0(0)	1(1) +Introduction to Fire Science Course	2(2)	5(5) +Grain Elevator Course and Hydraulic Calculation Course	2(2)	3(3)	0(0)	10(10)

[1]Indicates response from Insurance group.

[2]Indicates response from Industrial group.

[3]Indicates response from Government and Education group.

[4]Indicates response from Fire Service group.

[5]Indicates total of responses Combined group.

*Number without parenthesis represents respondents received from mailout.

**Number with parentheesis represents respondents received from interview.

The responses from the Identification of an appropriate Physics and Chemistry sequence are contained in Table II.

TABLE II

THE RESPONSES OF THE PARTICIPANTS CONCERNING THE PRESENT PHYSICS AND CHEMISTRY SEQUENCE (18 RESPONDENTS) BENEFITS THE STUDENTS

Opinion of Respondents	Responses From Group				
	Ins.[1]	Ind.[2]	Govrt.[3]	F.S.[4]	Total[5]
Change definitely should be made	3(3)	2(3)	0(5)	3(4)	8(15)
Change probably should be made	0(1)	2(1)	4(0)	1(0)	7(2)
Change probably should not be made	1(0)	0(0)	1(0)	0(0)	2(0)
Change definitely should not be made	1(1)	0(0)	0(0)	0(0)	1(1)

[1]Indicates responses from Insurance group.

[2]Indicates responses from Industrial group.

[3]Indicates responses from Government and Education group.

[4]Indicates responses from Fire Service group.

[5]Indicates total of responses.

The responses from the participants for the identification of non-fire science courses that should be included in the curriculum are contained in Table III. There were some courses identified that are already contained in the curriculum. These courses were omitted because they are departmental or university requirements and cannot be changed.

TABLE III

NON-FIRE SCIENCE COURSE SUGGESTIONS FOR INCLUSION IN THE CURRICULUM (18 RESPONDENTS)

Course Subject	Number of Times Suggested As: Required Course	Elective Course
Technical Report Writing	13(17)	0(1)
Public Administration	5(3)	0(3)
Emergency Medical Training	1(1)	0(3)
Organic Chemistry	2(4)	0(1)
Industrial Hygiene	2(2)	0(1)
Radiation Technology	1(0)	0(1)
Education Courses	1(0)	0(1)
Industrial Psychology	1(0)	0(1)
Computer Science	1(2)	0(1)
Engineering Economy	1(1)	0(1)

The information gathered in response to the review of Fire Science course topics, as to their relevance to the fire science specialist is contained in Table IV. The information received will be presented as data from the combined groups. The suggestions that are already part of the curriculum were omitted from the table.

TABLE IV

FIRE SCIENCE COURSE TOPIC CHANGES AS SUGGESTED BY THE PARTICIPANTS

Course Title	Suggested Changes	Number of Respondents
Construction Methods and Materials, FST 133	Add: Fire Rating and Tests for Construction Materials; Building Cost Analysis	3*(4)**
Fundamentals of Fire Prevention, FST 135	Add: National Building Code. Omit: Kansas Fire Code	2(3)
Water Supplied Systems, FST 303	Add: Increase the Amount of Hydraulic Calculations	2(4)
Rescue Practices and Procedures, FST 310	Omit: Entire Course should Should be omitted	2(2)

*Numbers without parenthesis represents responses received from mailout.

**Numbers with parenthesis represents responses received from interview.

CHAPTER V

SUMMARY AND CONCLUSIONS

Introduction

The purpose of the study was to develop a Fire Science curriculum for the Engineering Technology Department at Wichita State University. Chapter V contains the results of the study, the method of interpretation of the data, and the recommendations developed as a result of the study.

Results and Conclusions

A. Objective number one was to indicate which Fire Science courses belong in the Fire Science Technology requirement section. To determine these courses, the data received from the second round of the system evaluated. This data can be found in Table I. The first guideline was the total number of respondents who selected a particular course as a requirement. The second guideline was the number of respondents selecting the course as an elective. Identified in Table V are the courses that should be considered as required courses. While the Industrial Fire Safety course received a total of seventeen responses,

only twelve indicated the course should be required. It was felt that although this course is beneficial, the benefit would not be to all groups.

TABLE V

LISTING OF REQUIRED FIRE SCIENCE COURSES TO BE INCLUDED IN CURRICULUM

	Number of Respondents Selecting Course as Requirement	Number of Respondents Selecting Course as Elective	Total
Construction Methods and Materials, FST 133	16	0	16
Fire Detection and Suppression Systems, FST 134	15	2	17
Fundamentals of Fire Prevention, FST 135	12	5	17
Fire Hydraulics, FST 301	13	2	15
Water Supplies Fire Systems, FST 303	15	3	18
Hazardous Materials, FST 310	15	2	17

B. Objective number two was to identify which fire science courses belong in the Fire Science elective section.

The Fire Science elective section will consist of all Fire Science courses which are not included in the required section. Possibly the best use of the data is

to use the information from Table I as a guideline to students that have specific areas of interest within Fire Science.

The data from Table I indicated important Fire Science electives for each group, as shown in Table VI.

TABLE VI

IMPORTANT FIRE SCIENCE ELECTIVES AS SELECTED BY PARTICIPANTS

Insurance Selections	Industrial Selections	Government and Education Selection	Fire Science Selection
Industrial Fire Safety, FST 132	Industrial Fire Safety, FST 132	Fire Protection Management, FST 202	Industrial Fire Safety, FST 132
Fire Investigation, FST 311	Fire Investigation, FST 311	Tactics and Strategy, FST 302	Fire Investigation FST 311
Fire Risk Management, FST 492	Fire Risk Management, FST 492	Fire Investigation, FST 311	
Senior Projects, FST 498			

C. Ojective number three was to identify any non-fire science courses that should be included in the curriculum.

The non-fire science courses identified will be used as an advising tool with the exception of Technical Report Writing. Because of the high number of respondents indicating

a need for this course, it will be required of all Fire Science students. The remaining courses identified, Public Administration, Organic Chemistry, Emergency Medical Training, Education courses, Industrial Psychology, Computer Science, and Engineering Economy, will be listed as possible electives. Wichita State University does not currently have courses in Industrial Hygiene or Radiation Technology.

D. Objective number four was to identify an appropriate chemistry and physics sequence. The data in Table II was overwhelming in the belief that the chemistry and physics sequence should be as follow: General Chemistry 111 and General and Inorganic Chemistry 112 should be required with General Physics 213 (see Appendix).

E. Objective number five was to evaluate the fire science courses major topics for their benefit to the fire science specialist. The following adjustments will be made to the fire science courses.

1. Construction Methods and Materials, FST 133: Fire Rating and tests for construction materials and building cost analysis will be added to the course. This adjustment is being done because it is felt that the students should be introduced to the various procedures involved in rating materials. The building cost analysis will be beneficial to most specialists involved in any type of inspections of structures.

2. Water Supplied Systems, FST 303: The amount of hydraulic calculations will be increased because the majority of sprinkler systems being installed are calculated. This will better prepare our students when they enter the job market. The other suggestions put forth by the participants cannot be instituted at this time, because they would conflict with the Universities main goals, that is, to serve the community. The Kansas Fire Code and the Rescue class are both needed at the local level.

F. Objective number six was to develop an alternative Fire Science curriculum using the data gathered from this study. This curriculum should also stay with the constraints of the Department and University. The proposed fire science curriculum would be as follows:

1. 124 credit hours minimum required for graduation.
2. Twenty-six credit hours of mathematics and basic sciences. To include:
   A. Technical Algebra and Trigonometry, Math 110, five hours.
   B. Technical Calculus I. Math 251, three hours.
   C. Three hours of math or science electives.
   D. General Chemistry 111, five hours.
   E. General and Inorganic Chemistry 112, five hours.

F. General Physics 213, five hours.

3. Nine credit hours of communications. To include:
   A. College English 101, 102, six hours.
   B. Basic Public Speaking, Speech 111, three hours.
4. Four credit hours of free electives.
5. Nineteen credit hours of general technology courses. To include:
   A. Introduction to Engineering Concepts, Engineering 125, two hours.
   B. Engineering Graphics, I. E. 110, two hours.
   C. Introduction to Electricity and Electronics, E. T. 100, four hours.
   D. Statics, Dynamics and Strength of Materials, E. T. 200, four hours.
   E. Thermodynamics, Heat Transfer and Fluids, E. T. 300, four hours.
   F. Technical Report Writing, English 210, three hours.
6. Eighteen credit hours of required specialty courses. To include:
   A. Construction Methods and Materials, FST 133, three hours.
   B. Fire Detection and Suppression Systems, FST 134, three hours.
   C. Fundamentals of Fire Prevention, FST 135, three hours.

D. Fire Hydraulics, FST 301, three hours.

E. Water Supplied Fire Systems, FST 303, three hours.

F. Hazardous Materials, FST 310, three hours.

7. Three two-hour technical electives, nine of which can be non-fire science course. The elective courses may be selected from the following list with the approval of an adviser:

A. Fire Investigation, FST 311, three hours.

B. Industrial Fire Safety, FST 132, three hours.

C. Senior Projects, FST 498, one to three hours.

D. Fire Risk Management, FST 492, three hours.

E. Tactics and Strategy, FST 302, three hours.

F. Industrial Safety, MFT 257, three hours.

G. Fire Protection Management, FST 202, three hours.

H. Urban Fire Protection, FST 482, three hours.

I. Emergency Rescue Problems and Procedures, FST 350, three hours.

The non-fire related electives can be selected from any courses that the student and adviser agree upon.

Summary

The results derived from this study were satisfactory to achieve the desired objectives. However, without the results being implemented, the study will have limited benefits. It will be recommended to the College of Engineering during the summer of 1979 that the proposed curriculum be adopted while omitting the existing curriculum.

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12. McCormick, David, IAFF Studies, Open Learning for Fire Science, Fireword, Washington, D. C.: Department of Commerce, 1977, 3 pp.

13. National Commission of Fire Prevention and Central America Burning, Washington, D. C.: Government Printing Office, 1973.

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18. Wichita State University Catalog 1978-1979. Wichita: Office of Information and Public Events, 1978.

APPENDIXES

FIRE SCIENCE TECHNOLOGY CHECK LIST

February 1977 12-31-77ms

124 Hours Minimum Required for Graduation Name_____

Math/Comp/Natural Science

Mathematics and: Math 110(5)____Math 251(3)____Elective_____(3)_____

Basic Sciences (26): Chem 103(5)____Phys. 213(5)_____Phys. 214(5)_____

Communications (9): Engl. 101(3)____Engl. 103(3)____Speech 111 or 112(3)_____

Humanities and Fine Arts*		Social & Behavioral Sciences: (16)*	
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Free Elective (4): _____ _____ _____ _____

Technology Core (16): Engr. 125(2)_____ I.E. 110(2)_____

E.T. 100(4) ____E.T. 200(4)_____E.T. 300(4)_____

Required Specialty Courses (45): FST 132(3)_____ FST 133(3)_____

FST 134(3)_____ FST 135(3)_____ FST 303(3)_____

FST 302(3)_____ FST 301(3)_____ FST 310(3)_____

FST 311(3)_____ FST 350(3)_____ MFT 257(3)_____

FST 482(3)_____ Adm 348(3)_____ FST 492(3)_____

A.J. 202(3)____

Technical Electives (8):** Minimum of 6 hours of 300 level and above

_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

*Not fewer than 6 hours in each division. No more than 9 hours in any one department in these divisions. In each division, courses must be taken in at least two departments. At least 8 hours of General Studies must be taken in these divisions. Six credit hours must be 300 level and above.

**May be selected from the following with the approval of an adviser.

Acct. 210, Acct. 220, Adm. 360, Adm. 364, Adm. 366, Adm. 664, A.J. 340, A.J. 303, A.J. 201, Adm. 390, I.E. 213, A.J. 343, A.J. 100, CHE 110, MFT 355, E.T. 455, FST 498

A total of 40 semester credit hours must be in 300 level and above courses. In no case will work done in a two-year college be credited against this 40-credit-hour requirement.

PLEASE ANSWER ALL QUESTIONS AS CLEARLY AND ACCURATELY AS POSSIBLE.

1. Which FST courses should be included in the required specialty course section? Please indicate, by course number, a minimum of five (5) courses and a maximum of seven (7). (Refer to the attached course descriptions, but feel free to write in subjects that are not listed.)

2. Which FST courses should be included in the FST elective section. (Refer to the attached course descriptions, but feel free to write in subjects that are not listed.)

3. Should a two (2) course ten (10) credit hour chemistry sequence, Chemistry 111 and 112, be added to the FST curriculum while omitting Physics and Chemistry 103? Please refer to the attached course description.

   Mark only one (1) response.

   ___ a) This change should definitely be made.

   ___ b) This change should probably be made.

   ___ c) This change should probaly NOT be made.

   ___ d) This change should definitely NOT be made.

4. Identify any non-fire science course subjects that you feel are needed by the fire science specialists in the field.

5. Please examine the attached major topics presently covered in the FST courses. Indicate any topics that should be omitted or added to the courses. Keep in mind the changes should benefit the FST graduate in the field.

COURSE CATALOG DESCRIPTIONS FOR WICHITA STATE UNIVERSITY

Fire Science Technology

1. FST 132. INDUSTRIAL FIRE SAFETY

An examination of the causes and effect of industrial fires by examining industrial processes, equipment, facilities, common work practices of industry. Special emphasis will be placed on, but not limited to, the following subjects: (1) criteria for flammable liquid use, handling and storage, (2) warehousing of combustible commodities, (3) preplanning for emergencies, and (4) dip tanks and spray booths. Prerequisite: departmental consent.

2. FST 133. CONSTRUCTION METHODS AND MATERIALS.

The analysis of various building materials relative to their physical properties and their reaction to fire. The course includes the study of various building configurations and their applicability to specific hazardous industrial operations. Concepts of fire-resistive enclosures, partitions, fire walls or cut-offs are discussed as they pertain to the degree of the fire hazards present. The laboratory will stress construction type recognition, diagram interpretation and preparation. Prerequisite: departmental consent.

3. FST 134. FIRE DETECTION AND SUPPRESSION SYSTEMS.

Fire detection and suppression is studied with emphasis being placed on fixed and portable systems. The course material will cover, in detail, the following systems: (1) dry chemical, (2) carbon dioxide, (3) halon, (4) foam, (5) explosion suppression, (6) detection systems, and (7) automated computer controlled systems. These systems are examined with special emphasis placed on design, installation, and maintenance. Prerequisite: none.

4. FST 135. FUNDAMENTALS OF FIRE PROTECTION.

A study directed toward the recognition of various fire hazards, plus a survey of local, state, and national codes pertaining to fire prevention and fire safety. Prerequisite: none.

5. FST 202. FIRE PROTECTION MANAGEMENT.

A study of the basic managerial structure as it applies to the effectiveness of a fire protection organization. Prerequisite: departmental consent.

6. FST 301. FIRE HYDRAULICS.

Application of the laws of mathematics and physics to properties of fluid states, force, pressure and flow velocities. Emphasis is on applying principles of hydraulics to fire-fighting problems. Prerequisite: none.

7. FST 302. FIRE-FIGHTING TACTICS AND STRATEGY

Efficient and effective utilization of manpower, equipment and apparatus. Emphasis is placed on planning, fire ground organization problem solving related to fire ground decision making, and attack tactics and strategy. Prerequisite: none.

8. FST 303. WATER SUPPLIED FIRE PROTECTION SYSTEMS.

An in-depth analysis of water supplied fire protection systems. Specific topics of study will include (1) automatic sprinkler protection, (2) DeLudge systems, (3) preaction systems, (4) fire hydrants operating criteria, (5) fire pumps, and (6) stand pipes. Prerequisite: none.

9. FST 310. HAZARDOUS MATERIALS.

A review of basic chemical properties, storage requirements, handling precautions, laws, standards and fire-fighting practices related to hazardous materials. Prerequisite: departmental consent.

10. FST 311. FIRE INVESTIGATION.

Introduction to arson and incendiarism, legal aspects of arson and methods of setting incendiary fires. Also included are an analysis of the causes of fire, techniques for recognizing and preserving evidence, and means for interviewing and detaining witnesses. Procedures utilized in handling juveniles, court procedures and the giving of court testimony are also covered. Prerequisite: departmental consent.

11. FST 350. EMERGENCY RESCUE PROBLEMS AND PROCEDURES.

A discussion of the rescue procedures required by emergency personnel to perform their job. Also covers the specific hazards associated with natural and man-made disasters that are the results of our modern, technical society. Particular emphasis is given to the application of current hardware and procedural developments in the area of emergency rescue. Prerequisite: none.

12. FST 422. SELECTED TOPICS IN FIRE SCIENCE TECHNOLOGY.

New or special courses are presented under this listing on sufficient demand. Repeatable for credit. Prerequisite: departmental consent.

13. FST 482. URBAN FIRE PROTECTION AS RELATED TO CITY PLANNING.

Engineering analysis and design of urban fire facilities, including water supply, fire alarm systems, and the development of fire departments. Socioeconomic and management factors as related to city fire protection planning. Prerequisite: junior standing.

14. FST 492. FIRE RISK AND LOSS MANAGEMENT.

An analysis of business uncertainty; recognition of risks and their related loss potential; fire loss reduction through management control and protection systems. Assumption of risks through insurance programs. A study of security and liability as associated with condition of uncertainty.

15. FST 498. FIRE SCIENCE RESEARCH PROJECTS.

Selection and research of current topics in the field of fire science. Presentation of results of the research in the defending of any hypotheses advanced. Prerequisite: senior standing.

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[1]Wichita State University Catalog 1977-1978. Wichita: Office of Information and Public Events, 1977, pp. 196-197.

103. General Chemistry. (5). A survey of inorganic, organic, nuclear and biological chemistry. The course is recommended for the student who plans to take only one course in chemistry.

111. General Chemistry. (5). An introduction to the general laws of chemistry. Atoms, molecules, chemical arithmetic, gas laws, reactions, acids, bases, titrations, thermochemistry, phase equilibria, solutions and atomic and molecular structure are included.

112. General and Inorganic Chemistry. (5). Continuation of Chemistry 111. Thermodynamics, gaseous and ionic equilibria, kinetics, nuclear chemistry, electrochemistry, qualitive analysis and an introduction to organic chemistry.

213. General College Physics I. (5). Mechanics, heat and wave motion.

214. General College Physics II. (5). Electricity, light and modern physics. This course is a continuation of Physics 213.

MAJOR TOPICS IN FIRE SCIENCE COURSES

FST 132 - INDUSTRIAL FIRE SAFETY

- Plastics and other polymers
- Fire hazards of flammable and combustible liquids
- Spray booths and dipping operations
- Flammable liquid process and storage
- High piled storage practices
- Fuel fired heating equipment
- Combustion safety equipment
- Organization for private protection
- Computer facilities
- Dust hazards and control

FST 133 - CONSTRUCTION METHODS AND MATERIALS

- Construction recognition and classification
- Examination of various building materials
- Diagram preparation and interruption

FST 134 - FIRE DECTION AND SUPPRESSION SYSTEMS

- Chemistry of fire
- Portable fire extinguishers
- Carbon dioxide systems
- Dry chemical systems
- Halogenated systems
- Explosion suppression systems
- Specialized systems
- Fire detection and alarms systems

FST 135 - FUNDAMENTALS OF FIRE PREVENTION

- Indepth examination of Life Safety Code, various building codes, and Kansas Fire Code

FST 301 - FIRE HYDRAULICS

- Basic properties of water
- Basic formulas
- Principles of pressure in fluids
- Velocity of fluids
- Flow from nozzles
- Friction loss

Engine pressure and nozzle pressure

- Conducting water supply flow tests and recording data

FST 302 - FIRE-FIGHTING TACTICS AND STRATEGY

- Tactics and strategy on fire ground

FST 303 - WATER SUPPLIED FIRE PROTECTION SYSTEMS

- Conducting water supply flow tests and recording data
- Conducting fire pump test and recording data
- How to evaluate water supply tests and relate it to demand
- Examination of dry, wet, deludge, and preaction systems
- Conducting dry pipe valve tests
- Basic design considerations - NFPA #13
- Prepare a sprinkler drawing
- Standpipe systems
- Introduction to hydraulic calculations

FST 310 - HAZARDOUS MATERIALS

- Explosives
- Unstable materials

FST 310 con't.

- Rocket propellents and exotic fuels
- Water reactive materials
- Toxic and poisonous materials
- Corrosives
- Radioactive materials

FST 350 - EMERGENCY RESCUE PROBLEMS AND PROCEDURES

- Liability of rescue operations
- Handling radiation emergencies
- Ropes and knot practices
- Breathing apparatus
- Auto structure
- Extracation
- Aircraft rescue
- Numerous demonstrations of hardware and equipment used in rescue operations

FST 482 - URBAN FIRE PROTECTION AS RELATED TO CITY PLANNING

- Stresses in pipe
- Pumping stations
- Centrifugal and other pumps
- Well pumps
- Materials for and the design of pipe
- Valves, gates, hydrants and meters
- Metallic corrosion
- Design of distribution systems
- Construction and maintenance of distribution systems
- Factors that affect fire protection with a city

FST 482 con't.

- Fire defense planning for a city
- Organization structure of fire departments

FST 492 - FIRE RISK AND LOSS MANAGEMENT

- Senior level course which consist of a meshing together of fire science theories and practices. Plant visits and case studies are used to identify risks and the appropriate actions.

FST 498 - FIRE SCIENCE RESEARCH PROJECTS

- Senior level design or research project

FST 311 - FIRE INVESTIGATION

- Techniques for detection arson and incendiarism
- Legal aspects of evidence gathering
- Preserving evidence
- Legal aspects of arson investigation
- Court procedures
- Introduction to equipment used in arson investigation

VITA[2]

Leslie L. Reed

Candidate for Degree of

Master of Science

Thesis: FIRE SCIENCE TECHNOLOGY CURRICULUM STUDY FOR WICHITA STATE UNIVERSITY

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