Fire Engineering Education 1980

a survey on university educatinal activities within fire technology and fire engineering

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INSTITUTE OF BUILDING TECHNOLOGY AND STRUCTURAL ENGINEERING
AALBORG UNIVERSITETSCENTER · AUC · AALBORG · DANMARK

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FIRE ENGINEERING EDUCATION 1980

FRITS BOLONIUS OLESEN

FIRE ENGINEERING EDUCATION 1980. A SURVEY ON UNIVERSITY EDUCATIONAL ACTIVITIES WITHIN FIRE TECHNOLOGY AND FIRE ENGINEERING. 2ND EDITION
MAY 1980
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PREFACE

This report is the result of a survey concerning educational activities at university level within Fire Technology and Fire Engineering, carried out as a questionnaire in April 1980.

As the previous edition (Fire Engineering Education 1978), the report contains a list of some universities and other institutions all over the world, more or less involved in educational activities within this field, as well as a collection of descriptions of such activities at a number of institutions. The last-mentioned part of the report comprises a total of 32 descriptions, some of them very brief, and some of them giving a very thorough and detailed information about fire engineering educational activities going on as well as the general education systems of which they are a part at the different institutions.

Two things must be pointed out: Firstly the report, although considerably more covering than the previous edition, must not be considered a true picture of the fire educational situation, as it has not been possible to involve all relevant institutions, and the institutions involved have been selected more or less arbitrarily without any systematic attempt to collect a complete and representative information material about this item. Secondly it has to be pointed out, that the author alone is responsible for the compilation and editing of the received information, and any error or mistake this process might have given rise to, since none of the contributors have had the opportunity to proof-read their descriptions before printing.

For any error, misunderstanding, misprint or omission during the editing and reproduction process I express my sincere apology. Finally, I thank everyone who has given a contribution to this collection of information about educational activities within Fire Technology and Fire Engineering.

Aalborg 12 May 1980 — Frits Bolonius Olesen

INTRODUCTION

Within the fire research - as well as within other fields of research - information and communication are fundamental concepts. It is in the nature of all research work that it is vital for the individual scientist to keep currently informed of other scientists' works, and vice versa it is of great importance to the scientist to communicate his results to his colleagues. In order to meet these requirements, within almost all fields of research well-organized channels of communication are established in the form of periodicals, current series of bulletins and research papers, regular symposia and conferences, etc. To a great extent it is aimed at coordinating the research both nationally and internationally, e.g. through more or less firmly organized institutions of cooperation. Conseil International du Batiment is an example of such an organization, which through current mutual information across the boundaries aims at ensuring the best possible communication and in this way contribute to coordination of the international Building Research.

However, regarding what is the second main profession of many scientists, educational activities on university level, it is surprising to note how scarcely experience of this part of the profession is being exchanged. Even within the same country teachers at one university often know nothing or very little about the work of their colleagues at other universities within the same fields.

Undoubtedly, this is due to the fact that for the university teacher the educational activities do not contain elements of innovation and creation of new knowledge as is the case with the research activities, and therefore, current communication with colleagues, in casu other university teachers, is not felt necessary to the same degree.

This situation is explicable, but precarious, because it might lead to the teacher's work being routine and stiffened in thinking in grooves and not added the inspiration from outside, that is so decisive for his work as a scientist. But whatever might be meant about this question, it is a fact that in the educational field no such tradition of communication as in the research field is developed. As familiar as we are communicating our research activities, just as unfamiliar we are giving information about our educational activities.

This condition, of course, does not apply only to Fire Technology, but to all subjects, perhaps mostly the technical subjects. But you must be aware of it, when trying to establish communication on educational activities, and especially, perhaps, within such "new" subjects as Environmental Technology and Fire Technology, which have not even a specialist tradition as is the case with the classical subjects. And one could say that precisely this specialist "rootlessness" and lack of tradition which is characteristic for a new field as Fire Technology should give an urge to the greatest possible frankness and communication about basic educational problems.

CIB AND EDUCATIONAL MATTERS

As is well known, the main items of CIB are development and research and not educational problems. It is natural, however, that there is a number of university people among the participants in the meetings of the working groups, and that educational matters are raised now and then.

At the meeting in CIB/W14 (Fire Commission) in Washington D.C., March

1976, such educational matters were dealt with, and it was made clear, that the extent of activities differed widely from country to country, but furthermore it was made clear, that there is a gap in our knowledge how and to which extent educational activities within Fire Technology and Fire Engineering is carried out in the different countries. It was therefore decided that a survey on these matters should be carried out which could to some extent elucidate the situation and be presented and discussed at the next meeting (in 1978) in the Commission.

This decision was the background for a survey carried out from February to May 1978 and the result of which was the report "Fire Engineering Education 1978". This report was entitled "A preliminary survey" precisely to emphasize that it was to be considered rather as a collection of information about educational activities than a real systematic survey.

The report was presented and discussed at the 13th meeting of CIB/W14 in May 1978 in Copenhagen. On this occasion it was pointed out that the survey carried out was to be considered only as a first step, as it was far from giving a complete and true picture of the educational situation in this field, and it seemed clear that, as the next step, emphasis should be put on organization of a running and systematic communication about these matters.

THE SURVEY AND ITS RESULT

However, since the first edition of the report a lot of comments and positive response have come in, and there has been a request for a new and more complete edition. Thus, to fulfil this need, it was decided to prepare a new edition and compile it in the same way as the first edition, although the form of this might not be fully satisfactory. This has been done, partly for practical reasons, partly because, in accordance with the above-mentioned lack of tradition of educational communication, it still seems too ambitious to try to carry out a complete analysis of the position of Fire Technology in the technical educations on university level. Therefore, on a more modest level, as was the case by the preliminary survey, this second survey has been set up with the following purposes:

- to procure a broad outline of current educational activities which might serve as mutual inspiration and information and thus promote the communication and cooperation between educational institutions (e.g. by exchanging textbooks, notes, problems, etc.)
- to procure information to support the individual institutions in their reasoning for a policy aiming at strengthening Fire Technology as a technical field within the higher technical educations.

The main result of the survey are the information data collected in this report. It comprises a list of about 80 institutions (pages 5 - 11) more or less involved in fire engineering educational matters, and a collection of descriptions of the activities carried out at a number of institutions (32 descriptions on pages 12 - 81). Especially the descriptions have improved, compared with the 1978-edition; 10 "new" institutions have come to, mainly from the West-European countries, and most of the 22 previous descriptions have been revised or updated. The list of institutions has been completed, especially with French and Japanese institutions.

Although, thus, the result of this survey is considerably better than the result of the 1978-survey, it is important to note, that the descriptions worked out are still not sufficiently uniform to permit any conclusions to be drawn with respect to what really takes place at the individual institution. Furthermore neither the list nor the descriptions are sufficiently representative to give a true picture of the fire educational situation neither in the individual country nor in the different part of the world. In this context it has to be noted, that it has still not been possible to involve any East-European countries, African or South-American countries in the survey. And with respect to the West-European and North-American countries it is obvious that the descriptions are not fully covering for the real situation.

FINAL REMARKS

As was the case by the previous survey, the work with this survey has shown that it is not a quite easy task to establish a communication on educational matters and that university people in general seem to be rather unfamiliar with giving information about that part of their profession.

On the other hand, from the quick and thorough work carried out by the many contributors it is obvious, that there exists a real interest to participate in the communication also about the educational activities within Fire Technology and Fire Engineering. It may be hoped that this survey will stimulate this interest and that the report can serve as inspiration and be used as a tool for mutual information.

SOME INSTITUTIONS INVOLVED IN FIRE ENGINEERING EDUCATIONAL ACTIVITIES

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Page 36

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Page 38

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Page 42

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Page 40

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Page 44

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Page 46

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Page 47

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Page 52

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Page 54

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Page 55

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Page 58

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Page 56

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Page 62

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Page 67

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Page 72

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Page 79

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Page 80

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Page 81

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Australia

Members of the staff involved in fire-educational activities

R. M. Aynsley

Educational activities within the field of Fire Technology and Fire Engineering

The following course is included in the the curriculum of the Bachelor of Architectural Degree:

COURSE C12.105: FIRE AND SECURITY SYSTEMS ---------- 16 HOURS

Unit value: 2
Classes: Lectures 16 hours (8 2-hours lectures)
Assessment: Examination
This course deals with the fire resistance of materials, the design of buildings with relation to fire, the fire proofing of structures, fire a-larms, sprinklers and insurance, and concludes with various aspects of building security systems.
Programme: 1. Fire resistance of materials
2. Design of buildings with relation to fire
3. Ditto
4. Fire proofing of structures
5. Fire alarms
6. Fire insurance and sprinklers
7. Security systems
8. Ditto

THE NEW SOUTH WALES INSTITUTE OF TECHNOLOGY

AUS

Name and address of the institution

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Members of the staff involved in fire-educational activities

H.A. MacLennan
V. Ireland (Head of Department of Building)
B.R. Longfoot

plus part-time lecturers currently practising and carrying out research in the field of Fire Engineering

Summary of the general education system with special reference to activities within the field of Fire Technology and Fire Engineering

Generally

The Faculty currently offers three different undergraduate courses. The degrees awarded are:

Architecture Course	-	Bachelor of Architecture
Building Course	-	Bachelor of Applied Science
Quantity Surveying Course	-	Bachelor of Applied Science

A graduate course leading to the award of a graduate diploma in Urban Estate Management is offered as well as Masters' degrees by thesis.

The Faculty is also heavily committed to continuing education and has conducted a number of courses in Building Fire Protection centred around "Management of Fire Safety by Legislation".

All the courses within the Faculty are offered on a part-time basis. The educational technique used is one of co-operative education. This means that the industrial experience of each student is expected to reinforce his learning process.

Educational activities within the field of Fire Technology and Fire Engineering

The main set of building regulations for New South Wales came into force in July 1974 and is known as Ordinance No. 70. It is based on the Australian Model Uniform Building Code. The latter does not have any legal force. It is merely a Model Code, which one day will form the basis of all the Australian Building Regulations. The main impact of the Model Code has been and is in the area of Building Fire Protection. It was the advent of the legislation that focused attention on fire technology especially in terms of fire technology.

The basic approach to the teaching of fire technology in the undergraduate courses is as follows:

1. BUILDING COURSE

(a) Building Construction and Services Strand: A total of 40 hours is spent on Fire Technology by way of introductory lectures. Topics covered comprise:

(I) The nature of fire (incl. chemistry and dynamics) outbreak and growth of fire incl. fire in enclosures and hazards.

(II) Building occupancy in terms of activities, processes, etc. and their associated fire loads as a preliminary measurement of fire severity.

(III) Floor Area Limitations - problems of the size of buildings are studied together with the use of compartmentation. Fire loads are mentioned again together with the limitations of the concept.

(IV) Behaviour of materials incl. study of their early fire hazard properties.

(V) Study of structural assemblies and structures at elevated temperatures. Comparison of the Standard Fire Test and the standard time temp. curve as opposed to actual fire behaviour.

(VI) Study of egress.

(VII) Hydrant and Hose reel installations.

(VIII) Automatic Sprinkler installations.

(IX) Building Regulations - their use in management of fire safety by legislation.

(b) Building Management

Short coverage of systems approach to fire safety in the identification of project constraints.

(c) Fire Technology 1 and 2

The Building Course is subdivided into three vocational concentrations namely:

(I) Project and Construction Management
(II) Property Management
(III) Building Surveying

The above two subjects form part of a more advanced course in fire technology comprising a total of 64 weeks at 3 hours per week. A Committee has been formed to formulate it and they have resolved that it should consist of a number of modules. Each one of these will be self contained wherever possible. The Committee has also agreed that the course should be designed using a multidisciplinary approach so that course packages could be offered as electives in:

(I) Building Degree Course
(II) Architecture Degree Course
(III) Structural Engineering Degree Course

The topics that will be grouped in such a way so as to form fairly flexible modules are:

(I) Aspects of Chemistry and dynamics for Fire Protection including fundamentals of combustion and extinction.

(II) Fundamentals of the Fire Process, to include: flame types, flammability limits, burning of solids and liquids, burning in enclosures (detailed coverage), mechanics of extinction, pilot ignition, fire point theory, spontaneous ignition, general combustion, introduction to radiation hazard.

(III) The discipline and methodology of fire prevention.

(IV) Fire properties of materials to include: decomposition of materials, heat release in fires (including early fire hazard properties of materials), heat, smoke and toxic gases, test methods, behaviour of fabrics, and fire retardants.

(V) Escape Route design criteria to include human behaviour and or reaction under threat, number of people, route for movement, exit capacities and configuration, smoke movement and control, emergency communications and emergency lighting, structural fire protection criteria.

(VI) Fire Ground Theory: to be developed, but would include site planning for efficient access, ventilation, mobile fire fighting and rescue appliances, fire fighting mediums, fire brigade communications, breathing apparatus, training and administration, situation analysis, compartmentation for fire fighting etc.

(VII) Sources of ignition.

(VIII) Building Protection to include structural fire protection, recap of thermal and strength properties of basic materials, behaviour of steel components, reinforced concrete components and structures, loadbearing and non loadbearing brickwork, compartmentation, isolation, separation, doors and windows, fire resistance by test or "rational" design (to include critical appraisal) etc. (Will include detailed examination of the standard fire test AS1530 Part 4).

(IX) Fundamentals of Management by design - to include building life cycle, high rise buildings, places of assembly, the hospital, factories and warehouses, residential, other. (The same topics will be covered in Management by legislation).

(X) Active fire protection and detection systems - more detailed coverage developed from building services in earlier years of the building degree course.

(XI) Fire fighting equipment (e.g. hydrant installation).

(XII) Evaluation of Fire Risk (including existing buildings).

(XIII) Fundamentals of Explosions and Industrial hazards.

(XIV) Case studies.

(XV) Experimental Projects.

The course will be as comprehensive as possible within the time available. At present it forms part of the Building Surveying Concentration. It is hoped in the future that it will also be offered as a series of external courses for practitioners in industry at large.

The subject matter will require prior detailed knowledge of:

(I) Structures
(II) Building Materials
(III) Chemistry
(IV) Building Construction
(V) Quantitative Methods

(d) Maintenance Technology: That part of the subject dealing with the maintenance of Fire Safety Measures.

(e) Local Government Law and Administration III: That part dealing with Management of Fire Safety by Legislation - all relevant building regulations are covered.

2. ARCHITECTURE DEGREE COURSE

(a) Technology Strand.

Basically as per Construction and Services Strand in the Building Degree Course.

(b) Design.

The knowledge gained in (I) is expanded by research in the design studio. Management by legislation is used mainly but senior students are encouraged to use alternative methods. It is hoped that this angle will be strengthened by means of parts of Fire Technology 1 and 2 which may be offered as an elective in the near future.

(c) Electives: Using Modules from fire technology 1 and 2.

3. Various seminars and extension courses - basic coverage only - centred around building regulations - analytical approach used, i.e. philosophy and technology behind the various clauses of the regulations are studied.

Fire research activities with relation to Fire Engineering Education

Possibility of enrolling students in a Masters Degree to carry out research in fire technology is being studied.

DEAKIN UNIVERSITY AUS

Name and address of the institution

School of Engineering & Architecture
Deakin University
P.O.Box 125, Belmont, 3216
Victoria, Australia

Members of the staff involved in fire-educational activities

Professor R. A. Williams
Mr. P. Juler
in close collaboration with officers from the Country Fire Authority (CFA).

Summary of the general education system with special reference to activities within the field of Fire Technology and Fire Engineering

For some time the Deakin University has been working in close collaboration with the CFA in Victoria and a range of expert consultants in various aspects of Fire Technology to develop an Off Campus Diploma in Fire Technology. As a preliminary result of this collaboration a working group consisting of members of the university staff, officers from the CFA and representatives of a number of institutions and public authorities etc has carried out a paper "Proposed Graduate Diploma Programs" (January 1978) which is briefly summarized below.

It is intended to offer 2 "Fire" Units in 1979, Off Campus (Open University type courses) with further developments of other units in subsequent years. The proposed Graduate Diploma may be seen as the 1st stage in a progressive development of a centre of Fire Technology at the university, where not only a range of both On and Off Campus will be offered but also research undertaken into problem specifically related to the Australian situation and in particular to the needs of the Country Fire Authorithy of Victoria.

GENERAL

Each Graduate Diploma program offered by the School will consist of 8 semester units taken part time or by Off Campus study or by a combination of both.

At least 4 units shall be selected from those graduate units listed under Category A for each particular program. The selection of the particular Category A grouping will define the field of the diploma.

The remaining units shall be selected from those graduate units listed under Category B for each program.

Each program shall be approved by the Dean or his nominee.

Each Graduate Diploma in this School is classified as a "horizontal type diploma" and applicants for admission shall -

1. be a graduate from at least a three year full time program at Deakin University or other approved tertiary institution,
   or
   be a person with other qualifications and experience as may be approved by the Board of Studies of the School;
2. normally have at least 2 years relevant industrial experience in a field related to the selected program of study;
3. notwithstanding the requirements in 2, the Board of Studies may approve concurrent experience in lieu.

PROGRAM REGISTER

Graduate Diploma in Fire Technology.
Graduate Diploma in Industrial Engineering.

GRADUATE DIPLOMA IN FIRE TECHNOLOGY

This Graduate Diploma is directed principally at Engineers and Architects either in private practice, statutory authorities or industry who are concerned with the planning specification and/or design of buildings and their environment from the point of view of fire protection. It is being developed in close collaboration with the Country Fire Authority which sees this program as fulfilling an indentifiable need within Victoria.

Fire protection is an inherent factor in the design and construction of buildings, their surrounds, their contents and services to ensure the maximum safety of people and property in the event of fire. However, the degree of protection and the methods by which this is attained are dependent on the behaviour both of the fire and of the people under stress.

Fire Technology is therefore involved with not only protection but the science of fire, the fire properties of materials, the behaviour of fire in real situations, fire detection and alarm systems and the human reactions to fire.

Some graduates from this program will be operating principally at the advisory planning level rather than on detail design and therefore there will be a need for some administrative skills together with a knowledge of the economic factors relating to the provision of adequate fire protection. For this reason the course is designed to provide a series of secondary, optional units from the School of Commerce (or from any other School of the University if appropriate units are available).

PROGRAM

Category A. Units

At least 5 units must be selected from this category:

		Unit Value
EA 511.01	Fire Science 1 (compulsory)	1
EA 511.02	Fire Science 2	1
EA 512.01	Fire Properties of Materials 1 (compulsory)	1
EA 512.02	Fire Properties of Materials 2	1
EA 513	Human Reaction to Fire	1
EA 514	Fires in Confined Spaces	2
EA 515	Fires in Unconfined Spaces	2
EA 516.01	Design for Fire Protection 1	2
EA 516.02	Design for Fire Protection 2	2
EA 517	Fire Detection and Suppression Systems	1
EA 518	Project	2
EA 521	Factory Layout	1
CM 531	Administration (CM 161)	1
CM 532	Organisation Theory (CM 262)	1
CM 533	Management Theory (CM 262)	1
CM 534	Personnel Management (CM 361)	1
CM 535	Business Policy (CM 353)	1
CM 536	Operations Research (CM 292)	1

Study Mode

It is intended that all Category A Units will be offered as Off Campus Units in accordance with the following schedule:

Course	1979	1980	1981	1982
EA 511.01	✓			
EA 511.02			✓	
EA 512.01	✓			
EA 512.02			✓	
EA 513		✓		
EA 514		✓		
EA 515		✓		
EA 516.01			✓	
EA 516.02				✓
EA 517				✓

Category B Units will be available in the Off Campus mode as the Schools concerned develop the appropriate courses. In the meantime students can either take the subject as a part time On Campus student at Deakin, or with the prior acceptance and approval of the appropriate Dean, undertake an equivalent course at another tertiary Institution.

Educational activities within the field of Fire Technology and Fire Engineering

UNIT EA 511.01: FIRE SCIENCE 1 (CREDIT: 1 SEMESTER UNIT)

This unit builds on the student's existing knowledge of chemistry and physics with special emphasis on the first and second laws of thermodynamics and the concept of equilibrium as applied to those chemical reactions underlying the combustion process. External influences and the internal mechanics of the process are considered including ignition, modes of heat transfer, combustion rate and elementary explosion theory.

UNIT EA 511.02: FIRE SCIENCE 2 (CREDIT: 1 SEMESTER UNIT)

This unit is a further development of selected areas from EA 511.01.
Prerequisite: EA 511.01.

UNIT EA 512.01: FIRE PROPERTIES OF MATERIALS 1 (CREDIT: 1 SEMESTER UNIT)

Rates of heating: Emissivity; Surface heat transfer; heat capacity and conductivity; thermal diffusivity.
Reaction to heating: Change of state; thermal movement; pyrolysis; changes in moduli; ignition.
Combustible materials: Ignition and combustion processes; philosophy of fire testing of materials; standard testing; building code requirements; behaviour of materials including furnishings and fabrics.

UNIT EA 512.02: FIRE PROPERTIES OF MATERIALS 2 (CREDIT: 1 SEMESTER UNIT)

This unit is an expansion of EA 512.01 with particular emphasis on specific materials in their several grades and the varieties of plastics and flame retardent additives.
Prerequisite: EA 512.01.

UNIT EA 513: HUMAN REACTION TO FIRE (CREDIT: 1 SEMESTER UNIT)

This unit will be concerned with the psychology of stress with particular reference to the hazards of fire. The topics to be covered will include: Psychology of individual differences; temperament and stress; group behaviour and leadership; group behaviour under stress; social perception; special organization and welfare.

UNIT EA 514: FIRES IN CONFINED SPACES (CREDIT: 2 SEMESTER UNITS)

The ignition process; fire loads in compartments; significant variables and their effects; mechanism of fire spread; mechanism of smoke spread; venting of fires.

UNIT EA 515: FIRES IN UNCONFINED SPACES (CREDIT: 2 SEMESTER UNITS)

EA 515.01: General Principles of Fire Behaviour - 1 Unit

Combustion content of Australian forests and grasslands; properties of eucalypts; meteorological factors effecting fires; convective and radiative effects; fire intensity and rate of spread; flame temperatures.

EA 515.02: General Principles of Fire Prevention and Suppression - 1 Unit

Fire danger index and associated fire behaviour; small town fire protection; economics of protection and prevention; prevention strategies; damage and ecological effects; smoke.
Prerequisite: EA 515.01.

UNIT EA 516.01: DESIGN FOR FIRE PROTECTION 1 (CREDIT: 2 SEMESTER UNITS)

Philosophies of Layout: Classification of occupancies; spatial separation escape routes and safe refugees; pressurization control; effects on building services.
Compartmentation: Containment of fire; fire load and ventilation; fire spread characteristics; automatic closure.
Fire resistance ratings and choice of materials: Concept and outline of test criteria; provision of codes; fire resistance ratings; indices of rate of slame spread.
Escape routes: Evacuation policy; population densities; space requirements; criteria for number of routes and locations; lighting.
Building services: Smoke vents and curtains; ventilation systems; power and communication systems; electrical wiring; lifts.
Prerequisite: EA 514.

UNIT EA 516.02: DESIGN FOR FIRE PROTECTION 2 (CREDIT: 2 SEMESTER UNITS)

Extension of material in EA 515.01 with further case studies developing specific areas of importance.

UNIT EA 517: FIRE DETECTION AND SUPPRESSION SYSTEMS (CREDIT: 1 SEMESTER UNIT)

Fire detection systems; detection types and operation; automatic sprinkler systems, types and characteristics; foam, gas and dry chemical systems.

UNIT EA 521: FACTORY LAYOUT (CREDIT: 1 SEMESTER UNIT)

Production requirements - processes, machine and storage; optimum factory size, multiple factories.
Factory design - function; appearance; economic factors; environmental factors.
Materials handling systems - influence on layout; economic choice between alternatives; long-distance transport.
Layout design - by product, types of production line means of line balancing, queueing theory applications; by process, travel charts and computer programs for optimisation; practical aspects; provision of services and amenities; layout visualisation methods.

Supplementary remarks

The working group estimate at least 15 part time graduate diploma students in 1979 with this number increasing as the number of Off Campus units increases. In addition the CFA forecast a demand for individual units from its permanent officers and volunteer personnel seeking professional qualifications and promotional opportunities within the CFA. It is envisaged that in such instances course material would be provided by Deakin to the CFA at some negotiated figure. It is important to recognise that this course is unique within Australia and interest has already been shown by Fire Authorities in other states. Regulations differ but the principles of protection and prevention and the science of fire and its behaviour remain unchanged.
Individual units would also be offered as electives within our Architecture degree program thereby increasing the "market".

GHENT UNIVERSITY B

Name and address of the institution

Laboratory for fuel Technology and heat transfer
Department of Fire Engineering
State University Ghent Belgium
St. Pietersnieuwstraat, 41
9000 Ghent
Belgium

Members of the staff involved in fire-educational activities

Prof. Dr. ir. R. Minne
dr. ir. P. Vandevelde, Chef de Travaux
ir. G. Van Alboom, assistant
ir. Van Ooteghem, assistant

Summary of the general education system with special reference to activities within the field of Fire Technology and Fire Engineering

The Ghent State University is a complete university in which all studies on the university level are possible in the disciplines Law, Economics, Sciences, Applied Sciences, Psychology, Medicine, etc. These studies lead to legal degrees as doctor in Medicine, Civil Engineer, etc.

Fire Engineering is organized by the Faculty of Applied Science.

The Ghent University was created in 1817. University degrees can be obtained in

Applied Science
Medicine
Law
Literature
Economics, etc.

It is as such a complete university. Minimum four years full-time study to obtain a degree equivalent to Licentiée, and five years for a civil-engineering degree.

Dr.Ph. degree is obtained by working out, writing down and defending before the Faculty Professors an original scientific work.

Educational activities within the field of Fire Technology and Fire Engineering

At this day students in architecture must follow the lectures on "Fire Engineering", given by Prof.Dr.ir. R. Minne. (Lectures 22½ h. - exercises 12 h.). Other students of the Faculty of Applied Sciences can choose this course as one of the credits.

Fire research activities with relation to Fire Engineering Education

The students of the Faculty of Applied Science have to work out, write and defend before a jury an original scientific work before obtaining their degree of "civil engineer" after 5 years full-time study.

In this field, in our laboratory, the following subjects were treated and the work highly appreciated by the faculty:

- Reduced scale tests in order to study exothermal similarity;

- The reaction to fire of electric cables and other electric connections, more in particular perforations of the containment in nuclear reactors;
- Fire Resistance of non-protected or not protected steel and reinforced concrete columns;
- Non-stationary thermal behaviour of reinforced and prestressed concrete building elements computed with finite elements;
- Fire resistance of continuous floor slabs;
- Fire resistance of continuous reinforced concrete T-beams.

Available textbooks, notes, collection of problems, examination papers, etc. specially prepared for the fire-educational activities at the institution

The text of the lectures on "Fire Engineering" given by Prof. Minne exists in the Flamish language. That text comprises 240 pages. This text is not really edited as a book, only multiplied so that each student has his own copy.

Special publications concerning the fire-educational activities at the institution

A lot of publications have been produced by the laboratory in the field of fire engineering. They have been published either in Flamish or in French. They can be obtained by simple request. The list is too long to add.

UNIVERSITY DORTMUND D

Name and address of the institution

University Dortmund
Department Architecture and Building Engineering
Chair Load-bearing Constructions
August - Schmidt - Str.
D 4600 Dortmund 50 - Eichlinghofen

Members of the staff involved in fire-educational activities

W. Westhoff, Dr.-Ing., Honorar-Prof.

Summary of the general education system with special reference to activities within the field of Fire Technology and Fire Engineering

A curriculum of 4 years (= 8 semesters) leading to the "Diplom-Ingenieur" graduate level in the field of civil engineering.
In the 5.semester a short course (eight 2-hours lectures) in elementary fire protection engineering is offered.
The basis for this curriculum is the common basic training course of 1. - 4.semester and the projects and courses (mathematics, computer science, material science, mechanics, structural design, physics of building etc.)

Educational activities within the field of Fire Technology and Fire Engineering

Elementary Fire Protection Engineering (eight 2-hours lectures)

Fire aspects of the building regulations, national codes of fire testing and classification of building materials and constructions. Fire protection of load-bearing structures. Fire engineering design of concrete-, steel - and timber-structures.

Supplementary remarks

(1) The department Architecture and Building Engineering of the University Dortmund commenced its work in 1974. Since this time about 30 students of the civil engineering field have participated in the course on Elementary Fire Protection Engineering.

(2) The lector Prof. Dr.Westhoff is a member of the State Testing Institution Northrhine-Westphalia in which he is leading the department Building Materials. As a part of this department a group of about 20 (2 of them scientists, 6 graduated engineers) are working on the field of testing materials with respect to ignitability, flammability, smoke development, spread of flame and of testing the fire resistance of constructions (walls, floors, doors, ducts, shutters etc.).

(3) There are some reports about the work this group has done as fire research activities and some hundred reports with results of tests sponsored by commercial houses.
It ist not in the task of the State Testing Institution to work on the field of education.

TECHNISCHE UNIVERSITÄT BRAUNSCHWEIG D

Name and address of the institution

Institut für Baustoffe, Massivbau und Brandschutz
der Technischen Universität Braunschweig
Beethovenstrasse 52
D-3300 Braunschweig
Germany

Members of the staff involved in fire-educational activities

Prof. Dr.-Ing. Karl Kordina (V 1)

Prof. Dr.-Ing. Ulrich Quast (V 1)

Priv.-Doz. Dr.-Ing. habil. Ulrich Schneider (V 2 und V 3)

Dipl.-Ing. Volker Henke
Dr.-Ing. Wolfram Klingsch
Dipl.-Ing. Lore Krampf
Dr.-Ing. Claus Meyer-Ottens
Dipl.-Ing. Robert Walter

Summary of the general education system with special reference to activities within the field of Fire Technology and Fire Engineering

Grundstudium (1. - 4. Sem.)	Lehre über das Brandverhalten von Bauteilen in Vorlesungen über Baustoffkunde und Hochbaukonstruktion.
Grundfachstudium (5. - 6. Sem.)	
Vertiefungsstudium (7. - 8. Sem.)	Wahlvorlesungen (siehe V 1 bis V 2)

Educational activities within the field of Fire Technology and Fire Engineering

BRANDSCHUTZ IM BAUWESEN (V 1) (2 WOCHENSTUNDEN IM SOMMERSEMESTER)

Einführung in die Bauordnungen (Grundlagen zu DIN 4102), Brandverhalten von Massivbauteilen, Stahl- und Holzbauteilen, Erfahrungen bei wirklichen Bränden, Bewertung von Sonderbauteilen, Sicherheitstheorie im baulichen Brandschutz, Praktische Beispiele für brandschutztechnische Massnahmen, Versuchsvorführungen im Sonderforschungsbereich.

BAULICHER BRANDSCHUTZ IM INDUSTRIEBAU (V 2) (2 WOCHENSTUNDEN IM SOMMERSEMESTER)

Bauaufsichtliche Anforderungen an Industriebauten, Erläuterung des Entwurfs DIN 18 230, Teil 1 ("Baulicher Brandschutz im Industriebau"), Rechnerische Ermittlung der erforderlichen Feuerwiderstandsdauer, Sicherheitskonzept des Entwurfs DIN 18 230, Brandschutztechnische Regeln für den Bau und Betrieb von Industriebauten, Industriebauverordnung für den Brandschutz, Festlegung von Bauteilanforderungen (Planungsbeispiele), Festlegung von Brandabschnittsgrössen (Planungsbeispiele), Anwendungen und Grenzen von Brandschutzregelungen im Industriebau.

THERMISCHES VERHALTEN VON BAUSTOFFEN UND BAUTEILEN (V 3) (2 WOCHENSTUNDEN IM WINTERSEMESTER)

Grundbegriffe der technischen Thermodynamik, Wärme- und Stofftransportvorgänge in Bauteilen, thermisches Verhalten organischer und anorganischer Stoffe, Temperaturverhalten von Stahl und Beton sowie Stahlbetonkonstruktionen, Sicherheitsbetrachtungen am Beispiel des baulichen Brandschutzes.

Fire research activities with relation to Fire Engineering Education

Mitarbeit als studentische Hilfskraft im Sonderforschungsbereich "Brandverhalten von Bauteilen", Diplomarbeiten, (Abschlussarbeit für den akademischen Grad "Dipl.-Ing.") mit Themen aus dem Brandschutz auf Wunsch möglich.

Nach Abschluss des Studiums Mitarbeit als wissenschaftlicher Angestellter mit der Möglichkeit zur Promotion (akadem. Grad "Dr.-Ing.").

Habilitationsschrift

Schneider, U.: "Ein Beitrag zur Frage des Kriechens und der Relaxation von Beton unter hohen Temperaturen", (1979).

Dissertationsschriften in den Jahren 1975 bis 1980

Klingsch, W.: "Traglastberechnung instationär thermisch belasteter schlanker Stahlbetondruckglieder mittels zwei und dreidimensionaler Diskretisierung", (1975).

Haksever, A.: "Zur Frage des Trag- und Verformungsverhaltens ebener Stahlbetonrahmen im Brandfall", (1977).

Bechtold, R.: "Zur thermischen Beanspruchung von Aussenstützen im Brandfall", (1977).

Weiss, R.: Ein haufwerkstheoretisches Modell der Restfestigkeit geschädigter Betone", (1978).

Henke, V.: "Ein Beitrag zur Zuverlässigkeit frei gelagerter Stahlbetonstützen unter genormter Brandeinwirkung", (1980).

Available textbooks, notes, collection of problems, examination papers, etc. specially prepared for the fire-educational activities at the institution

Kurzfassungen des Inhalts der Vorlesungen.

Supplementary remarks

Es ist beabsichtigt, die Vorlesung "Brandschutz im Bauwesen" (V 1) als Pflichtvorlesung im Vertiefungsfach "Hochbaukonstruktion" in den Lehrplan des Fachbereichs Bauingenieurwesen aufzunehmen.

TECHNISCHE FACHHOCHSCHULE BERLIN D

Name and address of the institution

Technische Fachhochschule Berlin
Fachbereich Maschinenbau
Projektleitung für Fernstudien und Vorsitzender des
Fachbereichsrats Maschinenbau
Luxemburger Str. 10
D-1000 Berlin 65
Germany

Members of the staff involved in fire-educational activities

Professor Dr.-Ing. Erwin Lemke
and a large number of teachers for the special subjects.

Summary of the general education system with special reference to activities within the field of Fire Technology and Fire Engineering

FACHBEREICH MASCHINENBAU
TECHNISCHE FACHHOCHSCHULE BERLIN
Vorsitzender des Fachbereichsrats: Prof. Dr.-Ing. ERWIN LEMKE

Der Fachbereich MASCHINENBAU wurde im Mai 1972 nach der Wahl des Fachbereichsrats aus zwei Abteilungen (Maschinenbau und Fertigung) der damaligen Staatlichen Ingenieurakademie BEUTH Berlin gebildet. Das Studienprogramm umfaßt die beiden traditionsreichen Studiengänge (Studienrichtungen):

MASCHINENBAU

KONSTRUKTION und **FERTIGUNG**

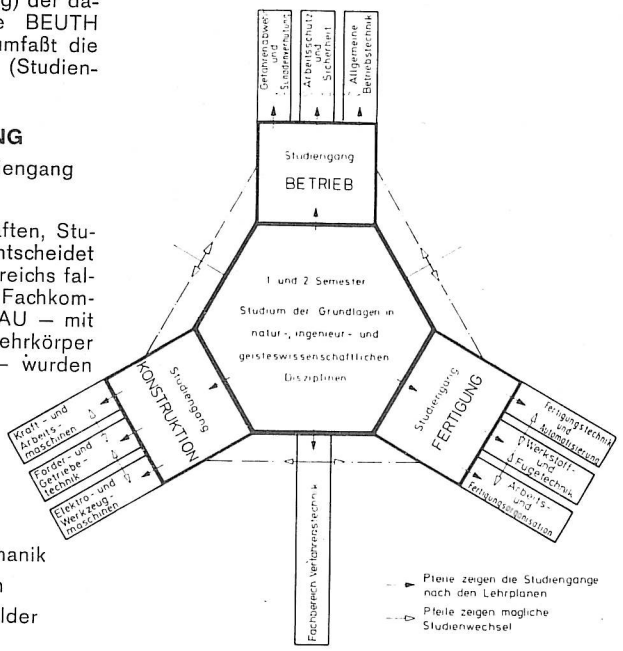
und einen völlig neu konzipierten Studiengang

MASCHINENBAU – BETRIEB

Der Fachbereichsrat besteht aus Lehrkräften, Studenten und Anderen Mitarbeitern. Er entscheidet über die in die Zuständigkeit des Fachbereichs fallenden Aufgaben. Zur Sicherstellung der Fachkompetenzen im Fachbereich MASCHINENBAU – mit einem etwa 90 Lehrkräfte umfassenden Lehrkörper (Hochschullehrer und Lehrbeauftragte) – wurden Fachgruppen gebildet:

FG 9/1 Automatisierung
FG 9/2 Produktionsregelung
FG 9/3a Werkstoffe
FG 9/3b Fertigungsverfahren
FG 9/4 Konstruktionselemente/Mechanik
FG 9/5 Kraft- und Arbeitsmaschinen
FG 9/6 Laboratorien und Versuchsfelder

Studienprogramm des Fachbereichs MASCHINENBAU



STUDIENPROGRAMM

Der Fachbereich MASCHINENBAU bietet drei Studiengänge im halbjährigen Turnus an:

Maschinenbau – KONSTRUKTION – MK

Maschinenbau – FERTIGUNG – MF

Maschinenbau – BETRIEB – MB

Im 1. und 2. Semester werden in Parallel-Veranstaltungen die Grundlagen der Natur-, Ingenieur-, Geistes-, Sozial- und Humanwissenschaften gelehrt. Nach umfangreichen, zum Teil individuellen Informationen am Ende des Grundstudiums kann der Student sich für einen der drei Studiengänge des Fachbereichs MASCHINENBAU – nach dem zweiten Semester – entsprechend seinen Neigungen entscheiden.

Auf den Seiten 49, 51 und 53 sind die Studienpläne für die speziellen Grundstudien der drei Studiengänge dargestellt. Am Ende des 4. Semesters ist mit dem Bestehen von drei schriftlichen Prüfungen in Grundlagenfächern das Vorexamen abzuschließen. Danach kann sich der Student für einen der drei Studienschwerpunkte in dem von ihm gewählten Studiengang entscheiden.

Studiengang: Maschinenbau — KONSTRUKTION
(Studienpläne s. Seiten 49 und 50)

a) Kraft- und Arbeitsmaschinen

b) Förder- und Getriebetechnik

c) Elektro- und Werkzeugmaschinen

Studiengang: Maschinenbau — FERTIGUNG
(Studienpläne s. Seiten 51 und 52)

a) Fertigungstechnik und Automatisierung

b) Arbeits- und Fertigungsorganisation

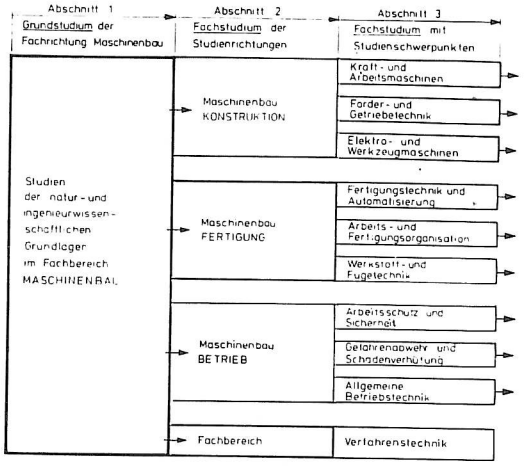
c) Werkstoff- und Fügetechnik

Studiengang: Maschinenbau — BETRIEB
(Studienpläne s. Seiten 53 und 54)

a) Arbeitsschutz und Sicherheit

b) Gefahrenabwehr und Schadenverhütung

c) Allgemeine Betriebstechnik



Studienprogramm des Fachbereichs MASCHINENBAU

Studiengang Maschinenbau — BETRIEB —

Der Studiengang BETRIEB ist in seiner Art und in seinen Studien- und Berufsmöglichkeiten einmalig in der Bundesrepublik Deutschland einschließlich West-Berlin. Die zu diesem Studiengang gehörenden Studienschwerpunkte

Arbeitsschutz und Sicherheit
Gefahrenabwehr und Schadenverhütung
Allgemeine Betriebstechnik

repräsentieren bedeutende Bereiche der Sicherheitswissenschaft und die vielfältige Anwendungspalette in allen Lebensbereichen sowie der Ver- und Entsorgungstechniken.

Es sei ausdrücklich vermerkt, daß im Studiengang BETRIEB keine Spezialisten ausgebildet werden und auch nicht ausgebildet werden können, weil eine Ausbildung von Spezialisten an den Hochschulen unserer Industriegesellschaft allein wegen der Möglichkeit der Freiheit der Wahl des Arbeitsplatzes sich verbietet. Darüber hinaus gehört zu den Merkmalen der Spezialisten, sieht man von denen ab, die in relativ kleiner Zahl überwiegend in der theoretischen Forschung tätig sind, neben gut fundiertem schulischen Wissen eine genügend große Erfahrung aus der Praxis. Diese Feststellung gilt grundsätzlich für alle Ingenieurwissenschaften und ganz besonders für die der Sicherheitswissenschaft.

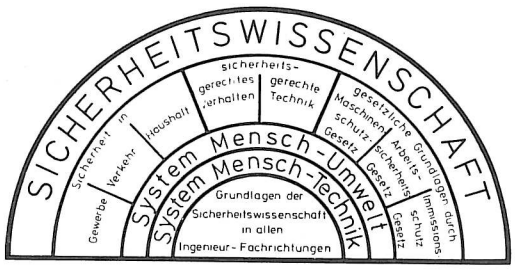
Der Studienschwerpunkt „Arbeitsschutz und Sicherheit" (siehe Seite 53) hat als Studienziel die Ausbildung von Ingenieuren, die (wie jeder andere Hochschulabsolvent) nach einer Phase der praktischen Einarbeitung als Fachkräfte zum vielfältigen Einsatz in den Bereichen der Sicherheitstechnik und ähnlicher Gebiete qualifiziert sind. Ihre Zuständigkeiten und Aufgaben sind größtenteils durch das Maschinenschutz- und das Arbeitssicherheitsgesetz festgelegt. Aber auch das Immissionsschutzgesetz, das besonders tief in die wirtschaftlichen und privaten Bereiche von Staat und Gesellschaft eingreift, stellt die Sicherheitsingenieure vor neue und komplexe Aufgaben.

Die Aufgaben der Ingenieure der Studienschwerpunkte „Arbeitsschutz und Sicherheit" und „Gefahrenabwehr und Schadenverhütung" werden in der Praxis häufig in Personalunion wahrzunehmen sein.

Ein großer Teil der theoretischen Voraussetzungen für einen solchen Einsatz wird in dem Fachstudium des Studienganges BETRIEB gegeben. Die nach dem Studium zu durchlaufende Berufspraxis erfordert jedoch entsprechende Gewichtungen.

Die Beschäftigungsverhältnisse der Ingenieure der Studienschwerpunkte „Arbeitsschutz und Sicherheit" und „Gefahrenabwehr und Schadenverhütung" umfassen grundsätzlich alle Möglichkeiten wie die als Beamte (bei staatlichen und halbstaatlichen Behörden), als Angestellte und in selbständigen Unternehmungen als freiberuflich Tätige (z. B. in Ingenieurbüros), die sich in sogenannten mobilen Sicherheitszentren zur Betreuung kleinerer und mittlerer Betriebe formieren können.

Im Studienschwerpunkt „Gefahrenabwehr und Schadenverhütung" (siehe Seite 54) werden besondere Lehrinhalte für die Ingenieure der Berufs- und Werksfeuerwehren und der Institutionen, die im wachsenden Umfang sich auch den Gefährdungen und Gefahren im System „Mensch — Umwelt" anzunehmen haben, berücksichtigt. Einerseits nimmt die Anzahl der Brandeinsätze bei den Feuerwehren ab, andererseits wächst jedoch die Gesamtzahl der Einsätze nicht zuletzt auf Grund zunehmender Technisierung in allen Lebensbereichen durch neue Werkstoffe und neue Technologien.



STRUKTUR UND INHALTE DER SICHERHEITSWISSENSCHAFT

Ingenieure dieses Studienschwerpunktes werden in der Zukunft viele im Immissionsschutzgesetz festgelegte Aufgaben zusätzlich zu übernehmen haben. Dazu gehört der Schutz von Menschen, Tieren, Pflanzen und Objekten vor schädlichen Umwelteinwirkungen wie Lärm, Schmutz, schädlichem Licht, gefährlicher Wärme und Strahleneinwirkung. Dem Vorsorgeprinzip zum Umweltschutz für Anlagen, Maschinen, Geräte und Fahrzeuge und der Standortfrage zum Beispiel von Betriebsstätten und von Siedlungsgebieten ist die gleiche Bedeutung zu geben wie dem Einschränkungsprinzip für die vorgenannten Bereiche.

Der Ingenieur als Immissionsschutzbeauftragter kann kein „Allerwelts-Umweltingenieur" sein, weil das dafür benötigte „Umweltstudium" nicht existieren kann. Lediglich Schwerpunktstudien sind praktikabel.

Der Studienschwerpunkt „Allgemeine Betriebstechnik“ (siehe Seite 54) hat als Studienziel die Ausbildung von Betriebsingenieuren für die Versorgungs- und Entsorgungstechnik, die auch vielfältige organisatorische Aufgaben, z. B. für das innerbetriebliche Transport- und Bauwesen sowie den Instandhaltungsdienst, beinhalten. Das Berufsbild ist häufig geprägt durch die Mitwirkung bei der Planung, Ausführung und anschließenden Betreuung von Projekten der Ver- und Entsorgungstechniken. Ingenieure dieses Studienschwerpunktes haben aus sachlichen Zwängen mit Fachkräften für Arbeitssicherheit und Brandschutz eng zusammenzuarbeiten. Auch daran ist zu erkennen, daß alle drei Studienschwerpunkte in dem Studiengang BETRIEB sinnvoll angeordnet sind.

Die Berufsfelder für die Absolventen der drei Studienschwerpunkte des Studienganges BETRIEB werden insbesondere mit der Durchsetzung gesetzlicher Verpflichtungen in starkem Maße geöffnet. Auf Grund der alle Bereiche der Wirtschaft, der Behörden und der Kommunen betreffenden Forderungen zur Verbesserung der Bedingungen in den Systemen „Mensch — Technik“ und „Mensch — Umwelt“ sind die Schwerpunkte „Arbeitsschutz und Sicherheit“ in hohem Maße relevant als Ergänzungsstudium für Absolventen anderer Studiengänge und anderer Fachrichtungen.

Beispiele für Ingenieurarbeit-Themen im Studiengang Maschinenbau - BETRIEB -

Entwicklung und Konstruktion einer Pulverfüll- und Prüfstation für Trockentank-Löschfahrzeuge.

Gefahren in privaten Lebensbereichen und die Möglichkeit, sie zu bekämpfen.

Es sind unfallverhütende Konstruktionen der Förder- und Lagertechnik zu untersuchen und an Hand von VBG-Vorschriften zu bewerten.

Art, Einsatz und Betrieb von Gas-Warnanlagen ist zu analysieren.

Die Technologie der Papierherstellung ist unter besonderer Berücksichtigung des Arbeits- und Nachbarschaftsschutzes zu untersuchen.

Es ist die Klimaanlage für ein Rechenzentrum zu entwickeln und zu bewerten.

Die Bedingungen zur Festlegung für das Tragen von Kopfschutzhauben sind zu untersuchen und auf ihre Wirksamkeit zu bewerten.

Es sind der Einfluß von Wartung und Pflege auf die Betriebs- und Unfallsicherheit von Elektrohandwerkzeugen sowie Kriterien für Kontrollfristen zu untersuchen.

Untersuchungen über die Zuverlässigkeitsraten von Endschaltern in Abhängigkeit von der Häufigkeit der Betätigung und dem zu vermeidenden Risiko.

Welche Maßnahmen sind zur Beseitigung von Ölgefahren auf Gewässern möglich, notwendig und vertretbar?

Untersuchungen über die praktische Verwendbarkeit von Feuermeldern, die drahtlos betrieben werden und den zur Zeit bestehenden Sicherheitsanforderungen genügen.

Entwicklung einer Tableauanlage für die Überwachung von ca. 500-600 Alarmfahrzeugen einer Großstadtfeuerwehr.

Studienplan

Studiengang BETRIEB

Spezielles Grundstudium im 3. und 4. Semester

Stoffplan Ordn.-Zahl	Lehrfach	Wochenstunden 3. Sem.	4. Sem.
01	Mathematik III+)	4	—
001	Problemorientiertes Programmieren und numerische Mathematik	2	—
32B	Technische Mechanik III+)	4	—
05	Werkstoffkunde III	2	—
005	Werkstoffprüflabor*)	—	2 m E
06	Fertigungsverfahren II	4	—
006	Fertigungslabor I*)	—	2 m E
07	Elektrotechnik III	2	—
007	Elektrolabor*)	—	2 m E
11	Kunststoff als Konstruktionswerkstoff	2	—
30	Wärmelehre	—	4
07B	Elektrische Maschinen und Anlagen I B und II B	2	2
31B	Förder- und Lagertechnik I B	—	2
33	Klimatechnik	—	2
34	Chemie der betrieblichen Gefahrenquellen	2	—
35	Physik der betrieblichen Gefahrenquellen	2	—
034 035	Labor für chemische Sicherheitstechnik*)	2 mE	—
09B	Maschinenelemente — Sicherheit I B und II B+)	2	2
36	Baukunde und Industriebau	2	4
38	Umweltfragen I	—	2
39	Arbeitsmedizin I	—	2
40	Kosten- und Investitionsrechnung	2	2
Summe		34	28

Hauptstudium im Schwerpunkt Arbeitsschutz und Sicherheit

Stoffplan Ordn.-Zahl	Lehrfach	Wochenstunden 5. Sem.	6. Sem.
041B	Maschinenlabor I B	2 m E	—
41B	Kraft- und Arbeitsmaschinen I B und II B	2	2
38	Umweltfragen II	2	—
18B	Arbeitswissenschaft I B und II B	4	—
39	Arbeitsmedizin II	2	—
42	Staub-, Lärm-, Strahlenschutz	—	4
43	Baulicher u. betrieblicher Brandschutz I B und II B	2	2
004B	Konstruktionsübungen Sicherheit I B und II B	2	2
44	Rechtsgrundlagen des Arbeitsschutzes	—	4
044B	Sicherheitstechnisches Praktikum I BAS (Fertigungslabor)	4	—
044B	Sicherheitstechnisches Praktikum II B und III B (Elektrolabor und Maschinenlabor)	2	2
45	Arbeits- und Brandschutzkleidung	—	2
043B	Brandbekämpfung I B	2	—
061	Ingenieurarbeit	8	6
Summe		32	24

Studienplan
Studiengang BETRIEB

Hauptstudium im Schwerpunkt Gefahrenabwehr u. Schadenverhütung

Stoff-plan Ordn.-Zahl	Lehrfach	Wochenstunden 5. Sem.	6. Sem.
041B	Maschinenlabor I B	2	—
41B	Kraft- und Arbeitsmaschinen I B und II B	2	2
38	Umweltfragen II	2	—
39	Arbeitsmedizin II	2	—
42	Staub-, Lärm-, Strahlenschutz	—	4
43	Baulicher u. betrieblicher Brandschutz I B und II B	2	2
044GS	Sicherheitstechnisches Praktikum GS (F-Labor)	2	—
044B	Sicherheitstechnisches Praktikum II B und III B	2 E-Lab.	2 KAM-L
043GS	Brandbekämpfung I B und II B	2	2
51	Fahrzeuge und Geräte I GS und II GS	4	2
52	Einsatz- u. Entscheidungslehre I und II	2	2
53	Rechtsgrundlagen I B und II B	2	2
062	Ingenieurarbeit	8	6
Summe		32	24

Hauptstudium im Schwerpunkt Allgemeine Betriebstechnik

Stoff-plan Ordn.-Zahl	Lehrfach	Wochenstunden 5. Sem.	6. Sem.
041B	Maschinenlabor I B	2	—
41B	Kraft- und Arbeitsmaschinen I B und II B	2	2
12AB	Werkzeugmaschinen I AB und II AB	2	2
13B	Automatisierungstechnik I B und II B	2	2
31B	Förder- und Lagertechnik II B	2	—
38	Umweltfragen II	2	—
17B	Arbeitsvorbereitung I B und II B	2	2
46	Maschinen-Instandhaltung	2	—
47	Ver- und Entsorgungstechnik (2 Std. Abwasser, 2 Std. Elektroinstallation)	4	—
42	Staub-, Lärm, Strahlenschutz	—	4
48	Verkehrstechnik	—	2
49	Werkschutz und Alarmanlagen	—	2
43	Baulicher u. betrieblicher Brandschutz I B und II B	2	2
043B	Brandbekämpfung I B	2	—
060	Ingenieurarbeit	8	6
Summe		32	24

Aufbau-, Ergänzungs- und Fernstudien im Fachbereich MASCHINENBAU

Im Fachbereich MASCHINENBAU können in den neun Studienschwerpunkten (s. Seite 6) Ergänzungsstudien durchgeführt werden. Dafür werden alle vergleichbaren Lehrinhalte aus früheren Studieninhalten anerkannt.

Im Rahmen anwendungstechnisch orientierter Forschung ist ein zweisemestriges Aufbaustudium für brennstofflose Energiegewinnung vorgesehen. Die Teilnahme an diesem Studium steht grundsätzlich allen Ingenieuren oder Diplom-Ingenieuren offen. Studienschwerpunkte sind Wärmegewinnung aus Solar- und Windenergie. Studieninhalte sind die notwendigen theoretischen Grundlagen und darauf aufbauend experimentelle Untersuchungen, insbesondere in anwendungstechnischer und wirtschaftlicher Hinsicht.

Der Fachbereich MASCHINENBAU plant die Erarbeitung und Erprobung von Fernstudien für die Gebiete Arbeitssicherheit, Umweltschutz und Feuerwehrausbildung, die für die gesamte Bundesrepublik Deutschland und Westberlin eine herausragende Bedeutung im Rahmen der Erwachsenenweiterbildung haben werden.

Available textbooks, notes, collection of problems, examination papers, etc. specially prepared for the fire-educational activities at the institution

About 1600 pages study-material as so-called letter courses.

Supplementary remarks

AUSBILDUNG FÜR DEN FEUERWEHRTECHNISCHEN DIENST DURCH FERNSTUDIEN

Der Fachbereich Maschinenbau der Technischen Fachhochschule Berlin bietet seit mehr als vier Jahren in einem in der Bundesrepublik Deutschland einzigartigen Studiengang "Betrieb" einen Studienschwerpunkt an, der die Ausbildung von Ingenieuren für Berufs-, Werks- und freiwillige Feuerwehren sowie für den Einsatz im Versicherungsbereich zum Ziel hat.
Dieser Schwerpunkt "Gefahrenabwehr und Schadenverhütung" ist nun auch die Grundlage für die Erarbeitung von Fernstudien zur Ausbildung von feuerwehrtechnischem Personal.

Im Rahmen eines Modellversuchs, der finanziert wird von der Bundesregierung (Bundesministerium für Bildung und Wissenschaft) und dem Land Berlin (Senator für Wissenschaft und Forschung Berlin) wird ein Fernstudienkurs für den feuerwehrtechnischen Dienst durchgeführt.

Das Fernstudienmaterial wird die nachstehend aufgeführten Lehrgebiete beinhalten:

- Chemie der betrieblichen Gefahrenquellen
- Physik der betrieblichen Gefahrenquellen
- Baukunde und Industriebau
- Baulicher und betrieblicher Brandschutz
- Brandbekämpfung
- Fahrzeuge und Geräte
- Einsatz- und Entscheidungslehre
- Rechtsgrundlagen

Das gesamte Fernstudium wird insgesamt 15 Kurseinheiten mit je ca. 75 Seiten und eine Studienanleitung umfassen. In dem dazugehörenden Glossar werden Fachausdrücke erläutert.

Die Studienanleitung wird dem Teilnehmer eine wesentliche Hilfe für das sinnvolle und rationelle Arbeiten mit Fernstudienmaterialien geben. Hiermit werden vielfach bewährte Methoden und Erfahrungen in Anwendung gebracht.

Durch diesen Modellversuch können sich ca. 110 Teilnehmer, die die grundsätzlichen Voraussetzungen zum Besuch eines Inspektorenlehrganges erfüllen, weiterbilden.

Die bisher gezeigte große Nachfrage erfordert für den Modellversuch eine Auswahl der Teilnehmer, die bis Mitte April 1978 abgeschlossen sein wird. Von diesen Teilnehmern werden ca. 100 Beamte der Berufsfeuerwehren und etwa 10 Mitglieder der freiwilligen Feuerwehren sein.

Der gesamte Druck des Fernstudiums wird im September 1978 vorliegen, danach beginnt das Betriebssystem, die sog. Durchführungsphase.
Die erste Kurseinheit, die Studienanleitung, das Glossar und die Sammelmappe werden ab Anfang Oktober 1978 an die einzelnen Teilnehmer versandt.
Die Durchführungsphase wird voraussichtlich am 30. Juni 1979 mit einer Prüfung abgeschlossen. Diese Prüfung kann in einer Dienststelle der Berufsfeuerwehr oder in Berlin an der Technischen Fachhochschule (an ein und demselben Tag) absolviert werden. Die erfolgreiche Teilnahme wird beurkundet.

Große Bedeutung wird der Betreuung der Teilnehmer und dem allgemeinen Feed-back zur Projektleitung gewidmet.

In jeder Kurseinheit befindet sich eine große Anzahl von Aufgaben zu den jeweils vorhergehend behandelten Abschnitten mit Hinweisen zu deren Kontrollmöglichkeiten. Am Ende der Kurseinheit wird der Lernende zum Beantworten einer Einsendeaufgabe (auf gelbem Papier) angehalten. Diese Beantwortung sollte höchstens zwei Schreibmaschinenseiten DIN A 4 umfassen; diese wird nach Prüfung, ggf. mit Korrekturen, an den Teilnehmer zurückgesandt. Darüberhinaus kann sich jeder Teilnehmer laufend an die Projektbetreuung schriftlich und fernmündlich zwecks Auskunft zu Fachfragen wenden.

Mit diesem Fernstudium soll letztlich jedem die Möglichkeit zur Erwachsenenweiterbildung auf den ständig an Bedeutung zunehmenden Gebieten der Gefahrenabwehr und Schadenverhütung gegeben werden.

Nach Abschluß des Modellversuchs wird dann dieses Fernstudium (ggf. auch in erweiterter Ausführung) allgemein in der Bundesrepublik Deutschland im Rahmen der Erwachsenenweiterbildung anzubieten sein, aber auch für die Ausbildung an Hochschulen und anderen Ausbildungsinstitutionen zur Verfügung stehen müssen. Damit kann dann nicht nur eine theoretisch unbegrenzt hohe Zahl ausgebildet werden, sondern es wird auch das Ausbildungsniveau auf einem hohen Qualitätsstand gleichmäßig sein können.

FACHHOCHSCHULE HAGEN D

Name and address of the institution

Fachhochschule Hagen
Fachbereich 2 - Bauingenieurwesen
Haldener Str. 182
D 5800 Hagen 1

Members of the staff involved in fire-educational activities

Prof. Dr.-Ing. Erwin Knublauch

Summary of the general education system with special reference to activities within the field of Fire Technology and Fire Engineering

Building Construction and Planning; 3 years course (minimum) to "Ingenieur (grad)" degree.

Educational activities within the field of Fire Technology and Fire Engineering

Elementary fire protection engineering in a 20 h course at the end of the first year.
Structural fire engineering design (36 h course) in the last year of studies.

Special publications concerning the fire-educational activities at the institution

Zur Frage der Ausbildung von Bauingenieuren im vorbeugenden baulichen Brandschutz; BAUWIRTSCHAFT Heft 41, 14. Oct. 1976, S. 1984.

AALBORG UNIVERSITY CENTRE — DK

Name and address of the institution

Institute of Building Technology and Structural Engineering
Aalborg University Centre
Danmarksgade 19
9000 Aalborg
Denmark

Members of the staff involved in fire-educational activities

N.J. Hviid, B.Sc.
J.R. Jørgensen, M.Sc.
F.B. Olesen, M.Sc.

Summary of the general education system with special reference to activities within the field of Fire Technology and Fire Engineering

At the Aalborg University Centre (AUC), which commenced operations in September 1974, qualifications can be obtained in the following areas: Arts, Social Sciences, Technology and Science. In its teaching at all levels AUC departs from the traditional lecture form and subject-organization. Instead the pedagogical concept is problemcentered project-organized training. Problem-solving is carried out by means of participation in courses of lectures, reading, study groups, tutorials and carrying out of investigations and experiments either in groups (normally) or individually.

All students commence by taking one of the following four, one-year basic training courses: Arts and Aesthetics, Language and Education, Social Science, Technology and Science. Following the basic training, the student is free to choose and combine his studies according to his own interest and ambitions. However, in order to obtain certain vocational qualifications, the student must follow in full or in part a recommended sequence of studies.

Following the basic training, the student decides on the main substance of his continued studies, which will be characterized by a gradual specialization. As in the basic year, the work in the superstructure is based upon projects accompanied by those courses and exercises relevant to the problem which the particular project attempts to solve. Courses and exercises relevant to the general subject of study are also held.

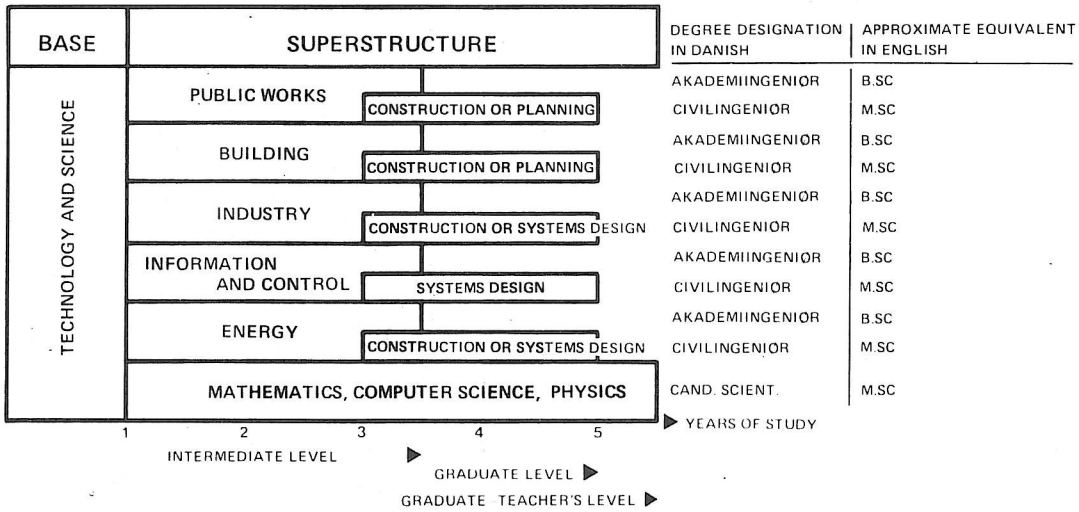
Within the area of Technology and Science there are two possibilities of engineering studies, at the intermediate level and at the graduate level respectively:

a) a Bachelor of Science curriculum of 3½ years' duration with specialization in one of the following five fields: Public work, Building, Industri, Information and Control, Energy,

b) a Master of Science curriculum of 5 years' duration with specialization in one of the following three fields: Planning, Construction, Systems Design.

The diagram gives a summary of these curriculae. The progress of a particular curriculum follows a horizontal line from left to right. It is a characteristic feature of the system, that not until the end of the 6. semester the student will have to make the choice whether to finish the study at the intermediate level (3½ year) and obtain a bachelor-degree or to continue the study to the graduate level (5 years) and obtain a master-degree.

In the superstructure of the engineering studies the activities are organized in a modular time-schedule system with a time-period of six ½-day sessions (i.e. 24 working hours) as the shortest unit. All projects and courses have a duration, which is a multiple of this "study-module", M. In each semester the project has a duration of 12-13 M, the courses have a total duration of about 15 M. Whether the student chooses the B.Sc.-curriculum or the M.Sc.-curriculum, the last semester (7. semester or 10. semester respectively) is almost fully occupied by the examination-project (about 25 M or 600 hours).



Within this engineering-education system Fire Technology is incorporated in two fields: The Building-field of the B.Sc.-curriculum and - in continuation of this - a special Fire Engineering Program within the Construction-field of the M.Sc.-curriculum.

In the Building-field of the B.Sc.-curriculum a short course (1 M = six ½-day sessions) in elementary fire protection engineering is offered (course 6341). In addition to this ad hoc instructions are given during the normal project-work from the 3. to the 6. semester. In the 7. semester the B.Sc.-students might choose to make their examination-project within Fire Technology either in full or in part. Normally this project would be concerned with a realistic engineering-work (e.g. structural fire engineering design of a highrise building, hotel or hospital), but it could also be a litterature-study, a laboratory-work or combinations of these.

In the Construction-field of the M.Sc.-curriculum a special one-year Fire Engineering Program (9. and 10. semester) is offered. In the 9. semester there are a project-work (see below) of 12 M (i.e. 288 hours), the courses 6342-6345 (see below) of 6 M (36 ½-day-sessions in all) and supplementary courses in physical chemistry, material science etc. The basis of qualifications for this program is partly the common basic training course of 1.-2. semester and the projects and courses (mathematics, computer science, physics, material science, mechanics, structural design, soil mechanics, hygrotermics, heating and airconditioning, economy etc.) of the 3.-6. semester of the Building-field, partly the special projects and courses (advanced mathematics and physics, continuum mechanics, experimental mechanics, finite element methods, structural reliability theory, advanced soilmechanics etc.) of the 7.-8. semester of the Construction-field.

In the 10. semester of the Fire Engineering Program the students make their examination-project, which normally will be a combined theoretical and experimental research-work within the field of structural fire engineering design.

Educational activities within the field of Fire Technology and Fire Engineering

COURSE 6341: ELEMENTARY FIRE PROTECTION ENGINEERING (1M = 6 ½-DAY SESSIONS)

Fires and fire damages. Fire aspects of the building regulations. National and international codes of fire testing and classification of building materials and constructions. Fire protection of load-bearing structures. Functional demands on structures and buildings with respect to fire safety.

COURSE 6342: BASIC FIRE TECHNOLOGY (1M = 6 ½-DAY SESSIONS)

Basic physical and chemical phenomena relating to fire and theories of extinguishment. Combustion, deflagration and explosion. The thermal processes. Ignitability and flammability. Limit of flammability of gases, vapours and dusts. Proporties of building materials with respect to combustion, smoke development, flame spread, corrosion, toxicity. Phases of the process of fire development. Ventilation controlled and fuel bed controlled fires.

COURSE 6343: STRUCTURAL FIRE ENGINEERING DESIGN (3M = 18 ½-DAY SESSIONS)

Principles and methods of differentiated fire engineering design of load-bearing structures. Safety methods, fire as an extreme load combination. Thermal load, the process of fire development, the equations of mass/heat-balance, fire load, the influence of ventilation proporties and the geometrical and thermal proporties. The influence of temperature on the thermal, strength and stiffness parameters of construction materials. Fire engineering design of reinforced and prestressed concretestructures, protected and non-protected steelstructures. Fireprotecting painting, concrete-filled and waterfilled steelstructures. Fire resistance of timberstructures and timber joints with mechanical fasteners.

COURSE 6344: EXPERIMENTAL FIRE TECHNOLOGY (1M = 6 ½-DAY SESSIONS)

Measurement of temperatures, electrical thermometry, thermocouples, pyrometry. Principles of furnace testing. Testing of load-bearing structures exposed to fire. Standard-test methods. Empirical methods for measuring of combustibility, smoke development, flame spread and taxicity. Measuring of thermal and mechanical proporties of building materials at high temperatures.

COURSE 6345: ACTIVE FIRE PRECAUTIONS (1M = 6 ½-DAY SESSIONS)

Fire detection. Detector types, thermal, smoke, flame. Installation of alarm and detector systems. Theories of suppression and extinguishment. Automatic sprinkler systems, foam extinguishing system, CO_2 extinguishing systems, dry chemical systems, halogenated agent extinguishing systems. Explosion suppression systems. Portable fire extinguishers, first-aid extinguishing equipment. Active fire-fighting, organization and equipment. Theories of fire-venting. Installation of fire-venting systems. Pressurisation.

PROJECT-WORK: FIRE SAFETY IN BUILDINGS (12M = 72 ½-DAY SESSIONS)

The project-work in the Fire Engineering Program of the Construction-field is placed in the 9. semester and constitutes together with the above mentioned courses (6342 - 6345) a coherent educational unit with the purpose to give the students a thorough knowledge of the theoretical basis of and to some extent a training in solving practical fire engineering problems.

Normally the basis of the project-work will be a sketch design plan for a building or factory plant with high degree of complexity with respect to fire problems. An analysis of the moments of fire risks is carried out and on this basis a program of the fire safety measures is drawn up.

The planning and design conditions of the fire safety of the buildings and the building constructions are set up, including external and internal sectioning, planning and design of escape routes, design conditions of the load-bearing and separating structures (fire load, fire development etc.), and at this basis a detailed fire engineering design of the buildings and a selection of typical and important buildingconstructions is carried out.

A detailed proposal program of active fire precautions is drawn up, including alarm and detecting system, fire venting systems, automatic sprinkler systems for special production processes and stores, especially vulnerable or vital technical installations, etc. A selection of the proposed installation systems are designed in detail.

The economical aspects of the fire safety measures are estimated, as well the initial expenditure as the running costs, and an organization plan for an internal plant protection unit is carried out.

Fire research activities with relation to Fire Engineering Education

Since AUC commenced operation in 1974 8 students have participated in the special Fire Engineering Program of the M.Sc.-curriculum. All of them have made their examination-project as a theoretical and/or experimental research-work, resulting in the following

STUDENTS RESEARCH PAPERS

Risk Evaluation, a Litterature Study (M.B. Bækgaard, 1979).

Creep Proporties of Structural Steel, experimental investigations (J.R. Jørgensen & A.H. Sørensen, 1979).

Fire-Resistance of Prestressed Concrete Beams, analytical and experimental investigations (L. Reimer, 1979).

Fully-developed Compartment Fires (G. Rosenkilde, 1979).

Fire-Resistance of Concrete-filled hollow Steel-sections, analytical and experimental investigations of the thermal proporties (E.E. Christiansen, 1980).

Fire-Resistance of Steel Columns, Litterature Study, theoretical and experimental investigations (H.K. Laursen, 1980).

Fire-Resistance of Joints in Steel-Structures, experimental investigations (H.O. Nielsen, 1980).

POSTGRADUATE STUDIES

A Postgraduate Study on The Fire-Resistance of Excentrically Loaded Steel Structures has just commenced (1980) and is expected to be finished in 2½ year with a Ph.D. degree.

The research projects mentioned above only comprise activities with a considerable educational purpose. The "normal" research work carried out by the staff of the institute is not mentioned.

DANISH ENGINEERING ACADEMY DK

Name and address of the institution

Department of Civil Engineering
Building 373
2800 Lyngby
Denmark

Members of the staff involved in fire-educational activities

B.-E. Carlsen M.Sc.

Summary of the general education system with special reference to activities within the field of Fire Technology and Fire Engineering

Danmarks Ingeniørakademi, abbreviated DIA, was established in 1957 in order to provide a Bachelor's Degree in engineering to supplement the traditional Danish Master's Degree, which requires five years of study.

DIA is incorporated in the Technical University of Denmark and is situated on the university campus at Lyngby, about 10 km from the centre of Copenhagen.

There are four departments: Civil, Electrical, Chemical, and Mechanical Engineering.

The Academy has also had civil, electrical and mechanical engineering departments in Ålborg in Jutland, but they are now incorporated in the University of Ålborg.

The Academy accepts students qualified in mathematics and science to university entrance level, and offers an intensive 3½ years course of study leading to the degree of "Academy Engineer". The aim is to give graduates the theoretical and practical knowledge and experience enabling them to practise as professional engineers in design, development, supervision and administration.

A thorough theoretical foundation is provided without losing sight of the practical application. Thus the student is taught the relevant branches of fundamental mathematics, physics and chemistry as well as the theoretical and empirical basis of specific engineering subjects. The student is trained in rational analysis of problems and encouraged to use his imagination to find untraditional solutions when orthodox methods prove inadequate. Nor is the impact of technology on society forgotten, this being treated under such topics as economic justification, sociology etc.

The normal course of studies extends over seven terms of half a year each. The autumn term runs from mid-August to mid-January and the spring term from mid-January to the beginning of July. One of the terms, usually the fifth, is devoted to practical work in industry, with Public Bodies or in commercial laboratories.

The other terms start with 16 weeks of intensive study with lectures and laboratory work. A 16 week series of lectures in a particular subject, comprising three hours of lectures and requiring about five hours of private study a week is called a "module". This is the brick with which the course of studies is built up.

Then follows 2½ weeks of examinations to determine whether or not the student has reached a satisfactory standard in the term's work. Unsuccessful candidates may resit their examinations at the end of the following term. After the examination period follows a period of few weeks devoted to full day activities such as surveying practice, time-consuming laboratory experiments or design projects.

The two final terms are chiefly devoted to practical engineering subjects and the student can choose from a range of optional modules in order to increase his

knowledge in fields of special interest. During the final term the student works on a major technical problem, his thesis project which he choose in consultation with the staff, and which may involve design, development, or research.

The lectures are held for clases of, at most, 24 students. This gives every student the opportunity of asking questions and starting discussions. Certain topics are treated in study groups of only five or six students. The students are required to attend 20 hours of lectures and to work 10 hours in the laboratory every week. In addition the average student will spend about 20 hours on homework, solving problems and preparing reports. Since the vacations are rather short, about two months a year including Christmas and Easter, it is obvious that the course of studies at the Academy is a demanding full time occupation and that it is impossible to combine it with other studies or part time work. It is the tight schedule of concentrated activity which makes it possible for DIA to offer a professional engineering education in such a limited time.

Educational activities within the field of Fire Technology and Fire Engineering

In the term 4 all the students in the Building-field are given a few lectures on the subject Fire-protection of buildings.

In the term 7 there is offered an optional course in Fire Technology, i.e. basic fire technology and structural fire engineering design (HB 73). This course runs for 14 weeks every autumn.

COURSE: FIRE TECHNOLOGY (1 MODULE = 28 LECTURES)

Fires and fire damages.

Basic phenomena relating to fire and theories of extinguishment. Combustion, ignitability and flammability, the thermal processes.

Testing and classification of building materials and structures. Building regulations and codes for houses, institution buildings and industrial buildings.

Risk evaluation. Fire venting, sprinkler systems, alarm systems, extinguishing systems.

Structural fire engineering design. Basic principles, the process of fire development. Design of steel-structures, timber-structures and concrete-structures exposed to fire.

Laboratory exercises and design exercises.

STUDENTS' THESISWORK

Finally a few students make their thesis in the field of fire technology.

TECHNICAL UNIVERSITY OF DENMARK DK

Name and address of the institution

Institute of Building Design
Technical University of Denmark
Building 118
DK-2800 Lyngby
Denmark

Members of the staff involved in fire-educational activities

Torben Jakobsen, M.Sc., C.S.E., Assoc. Professor
Kristian Hertz, M.Sc., C.S.E., Postgraduate Student Ph.D.

Summary of the general education system with special reference to activities within the field of Fire Technology and Fire Engineering

The Technical University operates an open system, in which the students can select and combine courses to their needs and wishes, restricted only by some conditions in succession of courses. A major part of the Building Engineering students, however, follows one of six so-called recommended study-lines.
The courses described below enters the lines of Building Technology and Building Design, but are frequently attended also by students of other lines, e.g. Structural Mechanics. Graduation-works within the field are not directly associated to the study-lines.

The courses are designed to be attended by students on their 8th and 9th semester of the 10 anticipated for the entire study.

The studies of this university leads to a degree as M.Sc. in Civil- and Structural Engineering.

Educational activities within the field of Fire Technology and Fire Engineering

Two courses: 6536 Building and Fire Engineering and 6537 Structural Fire Engineering, the latter just now introduced, are standard- or module-courses, running through 14 weeks each spring - and autumn semester respectively, with 2×2 lectures and training once a week. Examinations in written or oral conclude the courses.

COURSE 6536: BUILDING AND FIRE ENGINEERING

This course includes basics on Fire Statistics, Fire Terms, Fire Acts and Regulations, Testing and Classification, Planning of Buildings and Projects against Fire, Fire Properties of Building Materials, Process of Heating and Combustion, Heat Balance of Enclosures on Fire, Methods of Measurement and Monitoring, Fire Engineering Design of Building Structures, Building Services and Fire, Fire Prevention and Extinguishing Systems, Fire Protection of Industrial and Commercial Premises, Service Buildings and Public Institutions, Methods of Fire Risk Assessment.

COURSE 6537: STRUCTURAL FIRE ENGINEERING

This course is designed as an advanced course in Structural Fire Engineering, comprising: Thermal Loads on Building Structures and Members, Thermal and Mechanical Properties of Building Materials exposed to Fire, Models for Extimating Thermal and Mechanical Behaviour of Fire-exposed structures, their Members

and Connections. Calculation of Temperaturetime Levels and Stress-strain Relationships Practical Applications in Building Design and Construction.

Training courses are offered in fire-safety design, fire-engineering calculations, experimental work etc. and Individual courses also on selected subjects. These courses may be joint courses for 2-3 students. Furthermore, 3-5 students per year, on the average, are performing their graduation-works on much varying subjects within the field, in recent year frequently connected to the current research and development projects. - And finally, within context of such studies, candidates may carry out postgraduate studies of 2-3 years duration to obtain a degree as Ph.D. A study in Structural Fire Safety Design is presently being accomplished.

Fire research activities with relation to Fire Engineering Education

Graduation or individual works to be referred to are: Fire Spread Risks in Low-Rise, high density Habitations, Fire Safety Precuations and Costs in Older School Buildings, Fire Safety Problems in Old High-Density Residential Areas, Fire Loads in Industrial and Commercial Premises, Fire Protection of Light Steel Frames by Water-cooling, Fire and Sound Resistance of Light Steel Floor-units, Glassfiber-reinforced Concrete exposed to Fire, Fire endurance of Pre-stressed Concrete Units, Fire Properties of Danish Tentor Reinforcing Steel, Fire Properties of Surface Board and Lining Materials, Testing Procedures for Mechanical Strength of Fire-doors, Principles of Fire- and Smoke Ventilation Design. - All reports are, so far, in Danish language.

Available textbooks, notes, collection of problems, examination papers, etc. specially prepared for the fire-educational activities at the institution

Textbooks and lecturenotes:

Bygningsbrandlovgivningen (On Danish Fire Safety Acts and Regulations).

Plast og brand (Plastics and Fire) - made available.

Brandsikring af ventilationsanlæg (Fire Safety Design of Ventilation Systems).

Branddimensionering af trækonstruktioner (Fire Safety Design of Timber-Structures).

Moreover are used the Swedish books:

Brandteknisk Dimensionering (Structural Fire Safety Design).

Brand inomhus (Fire in the House).

Notes: Training problems and solutions. Selected notes, papers and reports.

Supplementary remarks

Building and Fire Engineering courses are run jointly with the Heating and Air Conditioning Laboratory of the University.

CENTRE SCIENTIFIQUE ET TECHNIQUE DU BATIMENT

F

Name and address of the institution

Centre Scientifique & Technique du Batiment
4, Avenue du Recteur Poincaré
75782 Paris Cedex 16
France

Members of the staff involved in fire-educational activities

M. Cami (Responsable de la Formation Professionelle continue au C.S.T.B.)
M. Mathez, Chef du Service Feu (Responsable des sessions de Sécurité au Feu dans les bâtiments)
Mme Majou, MM. Bellison, Hognon, Le Duff, Simonel, Touchais, Tourrette, Toyer (Membres du Service Feu assurant l'enseignement)

Summary of the general education system with special reference to activities within the field of Fire Technology and Fire Engineering

Le CSTB organise des sessions de Formation Professionnelle Continue sur les différents secteurs du bâtiment (construction, confort, nuisances, etc.) en particulier la sécurité incendie.

Les sessions de FPC sur la sécurité au feu dans les bâtiment ont lieu, deux fois par an, au Siége du CSTB, 4 Av. du Recteur Poincaré á Paris.

Elles s'adressent aux architectes, ingénieurs et techniciens supérieurs de bureaux d'étude, d'administrations ou d'entreprises, pour une initiation ou une révision de leurs connaissances sur les phénoménes du feu, les principes de la sécurité, les méthodes d'essais de matériaux et éléments de construction, le point des recherches, et la réglementation.

L'enseignement, étalé sur cinq jours, est dispensé par les ingénieurs du Service de Sécurité au Feu, sous forme de causeries allant de une heure á quatre heures, complétées par une visite des installations de CHAMPS-SUR-MARNE - visite au cours de laquelle des essais de démonstration sont faits pour les stagiaires.

Cet enseignement n'est pas sanctionné par un examen.

Educational activities within the field of Fire Technology and Fire Engineering

Le programme de ces sessions porte sur:

- les problémes de sécurité incendie et les exigences humaines, les principes de sécurité dans les bâtiments, et des généralités notionelles et terminologiques;
- les essais normalisés et réglementés de comportement au feu des matériaux (réaction) et des éléments de construction (résistance), les modalités d'essai, leur interprétation, et les résultats pour un certain nombre de matériaux et d'éléments;
- les problémes de désenfumage et les solutions technologiques cherchant á les résoudre;
- l'état de la recherche sur les phénoménes du feu et de la réponse des bâtiments;
- la réglementation francaise en matiére de sécurité incendie;

- des problémes divers et particuliers (cellules, facades, isolants, moyens de prévention).

En plus des causeries sur les sujets précédents, une visite des installations de CHAMPS, accompagné d'essais de démonstration, ets organisée pendant une journée; et des études de cas sur plan permettent le dernier jour de faire une synthése de la plupart des questions examinées.

Fire research activities with relation to Fire Engineering Education

Les nombreuses activités de recherche du Service Feu du CSTB lui permettent entre autres intérêts, de dispenser un enseignement toujours á jour des derniéres connaissances.

Available textbooks, notes, collection of problems, examination papers, etc. specially prepared for the fire-educational activities at the institution

Fascicule du "Recueil des Eléments Utiles.." (REEF) consacré á la Sécurité Incendie. Listes et tableaux divers.

INSTUTUT DE LA CONSTRUCTION INDUSTRIALISÉE I.C.I.

F

Name and address of the institution

Institut de la Construction Industrialisée (I.C.I.)
39, avenue d'Iéna
75116 Paris
France

or

55, rue de Ponthieu
75008 Paris
France

Members of the staff involved in fire-educational activities

Colonel Cabret, Civil and Military Engineer
Mr. Rilling, Engineer, CSTB, Fire Division

Summary of the general education system with special reference to activities within the field of Fire Technology and Fire Engineering

Post-graduate specialization, comprehending the teaching of: Building Sciences and Industrialized Technologies. Fire is taught among Building Sciences.

Educational activities within the field of Fire Technology and Fire Engineering

Fire teaching consists in 10 sessions + examination.
The summary of the course is as follows.

Available textbooks, notes, collection of problems, examination papers, etc. specially prepared for the fire-educational activities at the institution

In the REEF exists one chapter: Fire.
Collection of problems; examination papers exist, but are not available outward.

LEEDS UNIVERSITY GB

Name and address of the institution

Department of Fuel and Energy
The University of Leeds
Leeds LS2 9JT
England

Members of the staff involved in fire-educational activities

Professor A. Williams
Dr. G. Dixon-Lewis
Dr. W.A. Gray

Summary of the general education system with special reference to activities within the field of Fire Technology and Fire Engineering

At the present time the department offers the following courses:

At undergraduate level:

B.Sc. Fuel and Combustion Science (Honours and Ordinary)
B.Sc. Fuel and Energy Engineering (Honours and Ordinary)

and two unique combined studies courses

B.Sc. Fuel and Combustion Science - Chemistry (Honours), a course designed for fuel chemists, and
B.Sc. Fuel and Energy - Management Studies (Honours), a course designed to produce energy managers.

At postgraduate diploma level:

Postgraduate Diploma in Fuel and Combustion Science
Postgraduate Diploma in Fuel and Energy Engineering.

M.Sc. Courses:

M.Sc. in Combustion and Energy
M.Sc. in Environmental Pollution Control.

Research work: The interests of the department cover the whole range of gaseous, liquid and solid fuels, combustion, nuclear and alternative forms of energy, energy utilisation and also fire science. Research work leading to M.Phil. or Ph.D. can be undertaken in most of these areas.

Short courses: The department runs short courses on matters of current interest, particularly fire and explosion, energy topics and environmental pollution.

Educational activities within the field of Fire Technology and Fire Engineering

Undergraduate Courses:	Basic combustion	50 - ½ day sessions
	Fire technology and fire precuations	6 - ½ day sessions
M.Sc. course in Combustion & energy :	Basic combusion	100 - ½ day sessions
	Fire technology and fire precautions	5 - ½ day sessions

Fire research activities with relation to Fire Engineering Education

Continuing research work on basic combustion processes and the spread of fire through solid structures.

Available textbooks, notes, collection of problems, examination papers, etc. specially prepared for the fire-educational activities at the institution

Prints of lectures given on annual two-day courses on Fire and Explosion are available.

IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY

GB

Name and address of the institution

Department of Chemical Engineering and Chemical Technology
Imperial College of Science and Technology
Exibition Road
London SW 7
England

Members of the staff involved in fire-educational activities

Dr. D. H. Napier
Dr. K. E. Bett
Professor F. R. Farmer

and a number of visiting lecturers

Educational activities within the field of Fire Technology and Fire Engineering

INDUSTRIAL SAFETY. A FULL-TIME M.SC.-COURSE OF ONE YEAR
(Not currently offered)

The course is mainly concerned with a study of the scientific principles underlying hazards and methods employed to produce safe conditions; the application of these principles is also studied. The whole of the material is set against the background of industrial safety.

The course consists of lectures, tutorials and research and comprises the following lecture courses with relation to fire technology:

GENERAL ASPECTS OF INDUSTRIAL SAFETY (7 lectures)

(Dr. D. H. Napier and visiting lecturers)
Legal considerations; relevant principles of insurance; statistics; economics; ergonomics; psycology; safety services and information; organization for safety.

IGNITION OF GASES (8 ½-day sessions)

(Dr. D. H. Napier, dr. K. E. Bett and visiting lecturers)
Spontaneous ignition of gases; composition ranges of ignitability; ignition by local thermal sources; ignition by electrical discharges; practical applications to the ignition hazard.

PROTECTION AGAINST THE EFFECTS OF GASEOUS EXPLOSIONS (8 ½-day sessions)

(Dr. J. H. Burgoyne and dr. K. E. Bett)
Development of pressure in gaseous explosions; design of plant to contain explosions; protection of plants against pressure effects of gaseous explosions; effects of explosion upon surroundings; structural protection against explcsion effects; practical applications.

GAS EXPLOSIONS (8 ½-day sessions)

(Dr. D. H. Napier, dr. G. Munday and visiting lecturers)
Ranges of flammability of gases; development of gas explosions; explosion suppression and relief; dust explosions; mist explosions; decomposition explosions; practical applications to the explosion hazard.

FIRE HAZARD OF MATERIALS (8 ½-day sessions)

(Dr. D. H. Napier and visiting lecturers)
Dispersion and ignition of gases; ignition of liquids; burning of liquids and extinction; spontaneous combustion, ignition and burning of solid materials and extinction; practical applications.

FIRE HAZARD OF BUILDINGS AND THEIR CONTROL (7 ½-day sessions)

(Dr. D. H. Napier and visiting lecturers)
Principles of combustion; development and spread of fire in and between buildings; detection of fires; fire extinguishment; burning of elements of structure.

UNDERGRADUATE COURSES

The following course is given during the 3rd year:

ChE.304: SAFETY ENGINEERING (19 lectures)

(Dr. D. H. Napier and Professor F. R. Farmer)
Basic philosophy of industrial safety. Legal and economic factors influencing the safety standards of operations.
Sources of ignition. Flameproof and intrinsically safe equipment.
Explosion and fire hazards of gases and flammable liquids. Flame arresters and explosion relief. Dust explosions.
Toxic hazards. Dispersion of toxic materials in the body and in the working environment. Hazard Analysis.

OTHER COURSES

In the 6 month Certificate Course on Occupation Safety and Health the following lecture courses are included:

EXPLOSION HAZARDS (12 lectures)

(Dr. D. H. Napier and specialist Inspector)
Point source and homogeneous ignition; ignition sources; auto-ignition temperature and minimum ignition energy; flammability limits; development of explosions; dust explosions; deflagrations and detonations; unstable materials; energetics of explosions; effects of explosions; TNT equivalents and scaled quantities; explosion suppression; explosion relief; unconfined vapour cloud explosions.

H.S.E. custom and practice on dust explosions.

FIRE HAZARDS (12 lectures)

(Dr. D. H. Napier and specialist Inspector)
Combustion of bulk liquids and solids; fires in practical systems; self-heating and run-away reactions; segragation of risks and compartmentation; fire spread in compartments, in buildings and between buildings; Fire detection and protection; principles of extinguishment, inhibition and fire-retardancy; behaviour of building materials and components in fires.

H.S.E. custom and practice on:

(a) highly flammable liquids
(b) fire certification in special premises.

SHEFFIELD UNIVERSITY — GB

Name and address of the institution

Department of Chemical Engineering and Fuel Technology,
Sheffield University, Sheffield S1 3JD,
England.

Members of the staff involved in fire-educational activities

Professor J. Swithenbank
Dr. D.J. Brown

Fire research activities with relation to Fire Engineering Education

Postgraduate research for M.Sc. and Ph.D. degrees in fields of pool burning, fabric flammability and burning of wood and plastics.

Special publications concerning the fire-educational activities at the institution

Annual Research Report to Departmental Advisory Committee.
Reports to research sponsors (e.g. Fire Research Station).

UNIVERSITY OF EDINBURGH GB

Name and address of the institution

Department of Fire Safety Engineering
University of Edinburgh
The King's Buildings
Edinburgh EH9 3JL
Scotland, GB

Members of the staff involved in fire-educational activities

Professor D.J. Rasbash
Dr. E.W. Marchant
Dr. D.D. Drysdale
Mr. R. Hirst

Summary of the general education system with special reference to activities within the field of Fire Technology and Fire Engineering

The University of Edinburgh is a large and ancient centre of learning. At present its 8,700 undergraduate and 2,500 postgraduate students belong to one of the 150 academic departments. These departments are collected into eight faculties which include Arts, Medicine, Law, Social Science and Science. Fire Safety Engineering is one of five departments of engineering within the Faculty of Science.

The Scottish student can obtain an "ordinary" degree after 3 years study or an "honours" degree after a further year (BSc or BSc (Hons)). Each year is divided into three terms of 10, 10 and 8 weeks duration. The hours of study in a year vary widely but the student of Engineering is required to attend about 15 one-hour lectures each week for 24 weeks. Associated laboratory, tutorial and project work amounts to about 9 hours per week for 24 weeks. The Department of Fire Safety Engineering has two postgraduate courses leading to a Diploma in Fire Engineering or the intermediate degree of Master of Science (MSc) in Fire Engineering.

A course entitled "Design against Fire" (DAF) is given to 4th year students of Architecture (Faculty of Social Science) and consists of ten 1½ hour lectures.

An optional course on "Fire Safety Design" (FSD) will be offered to 5th year (a "postgraduate" year) Students of Architecture in 1978-79 and is scheduled for 45 1-hour lectures and 18 hours (6 afternoons) of laboratory and project work.

Fire studies are offered at 4th (Honours) year level to students of Civil Engineering and Building Science (Faculty of Science) as one of their "optional" subjects and is regarded as about one-fifth of the work load in the year. The course is entitled "Fire Safety of Building Structures" (FSBS) and is scheduled for 45 1-hour lectures and 18 hours (6 afternoons) of laboratory and project work.

At post-graduate level the Department of Fire Safety Engineering runs Diploma and MSc courses in "Fire Engineering" (FE).

The courses are similar for both qualifications with study from October to June and examinations at the end of this period. However, students for the MSc degree carry out a supervised research project of 3-4 months duration and submit a dissertation on the research work by the end of September.

The qualifications expected normally from applicants for the MSc course is an Honours degree in an approved subject. These include Chemistry, Physics, Statistics and Operational Research; Civil, Chemical, Mechanical and Electrical Engi-

neering; Architecture, Building and Marine Architecture. Applicants for the Diploma course are graduates in an approved subject or hold a qualification that can be accepted as equivalent to a first degree.

The course contains about 240 one-hour lectures and 12 laboratory projects on the measurement of various fire safety parameters totalling approximately 72 hours. These projects are linked closely with the lecture courses as are the calculative exercises issued for various topics. Six short design projects are carried out also (e.g. sprinkler system design) and about 18 hours is allowed for each project. The MSc students are expected to carry out a short research project (3 month) and some titles are listed below (Fire research activities).

Educational activities within the field of Fire Technology and Fire Engineering

COURSE DAF: DESIGN AGAINST FIRE (12½ HOURS)

An introductory course for students of architecture:
Fire Safety and the Building Life Cycle and integration of Fire Safety in the Design Process: Nature of Combustible Contents of Buildings, especially Smoke Production, including Effects on People, Smoke Movement and Control in Buildings: Emergency Communications and Detection Systems: Escape Route Design and its relationship with Smoke Control Systems: Active Suppression Systems: Passive Fire Barriers: High Temperature Performance of Constructional Materials including Wood, Steel, Aluminium and Concrete: Methods of Passive Fire Protection to Structures (Isolation, Insulation and Transmission): A Review of Current UK Fire Safety Legislation.

COURSE FSD: FIRE SAFETY DESIGN (45 HOURS)

An advanced course for students of architecture:
Fire Safety Management (The legislative, insurance, industrial and commercial approaches to the control of fire losses): Hazard Evaluation (Hazard identification and quantification, insurance, fire services and rational approaches to evaluation): Escape Route Design (human reaction to threat, reception of signals, design density and effective numbers of people): Smoke Control (Smoke load, smoke production, behaviour of plumes. Natural venting. Mechanical control (pressurisation). Choice of appropriate control systems: includes calculation of systems and design exercises). Detection and Alarm Systems: Operation, selection and siting of smoke and heat detection systems, including optical and thermal sensors. Acoustic design of alarm systems: includes some calculation and design exercises. Active Suppression Systems (Operation, selection, design and use of liquid, gaseous and foam systems. Passive Fire Control Techniques (Selection and specification of fire barriers. Consideration of barrier integrity). Systems approach to fire safety; (Use of fault tree analysis and other techniques to achieve a balanced fire safety design).

COURSE FSBS: FIRE SAFETY OF BUILDING STRUCTURES (45 HOURS)

Fire protection on Construction and Demolition Sites; Smoke Load Evaluation and Smoke Density Calculations; Heat Transfer; Calculation of Temperature Regimes in Enclosures: Quantitative Analysis of Fire Safety: Statistics of Fires and Fire Load: Fires in Enclosures: Methods of Predicting Fire Growth and Fire Severity: High Temperature Thermal and Structural Behaviour for Steel and Concrete Structures. Fire Resistance Procedure for Reinforced Concrete and Timber Structures: The use of Concrete or Water filled hollow steel columns: Progressive Collapse: Explosion Resistance: and the Reinstatement of Concrete Structures.

COURSE FE: FIRE ENGINEERING (220 HOURS)

Courses DAF + FSD + FSBS plus
PRINCIPLES OF FIRE PROCESSES (Thermodynamics and kinetics of combustion reactions. Fire properties of combustible gases, liquids and solids. Dimensions, structure,

intensity and velocity of flames. Heat transfer from flames. Fire developments and steady burning in the open and in enclosures. Fire severity. Theories of spontaneous and pilot ignition. Mechanisms and sources of ignition. Theories of extinction and blow out. Extinguishing agents. Combustion of carbon. Smouldering).

EXPLOSIONS AND SPECIAL HAZARDS (Flame propagation. Flammability limits. Laminar and turbulent deflagration, detonation. Gas and vapour explosions in enclosures and in the open. Maximum pressure and rates of pressure rise. Flame quenching and arresters. Explosion relief. Dust explosions. Explosion-proof equipment. Dispersion of flammable vapours. Fire in oxygenated atmospheres. Hazardous exothermic reactions).

MECHANICAL AND ELECTRICAL SYSTEMS (Effectiveness, reliability, design, installation and maintenance of automatic detection and extinguishing systems).

FIREFIGHTING AND FIREMANSHIP. (Organisation of fire services. Mobile firefighting and rescue appliances. Extinguishers, hose reels, hydrant systems and water supplies. Properties of jets and sprays. Use of water, foam and special agents in manual firefighting. Breathing apparatus and protective clothing. Ventilation of fires. Flashback and other special firefighting risks. Communications).

EVALUATION OF FIRE SAFETY. (Place of fire safety in the community. Appraisal and use of fire statistics. Empirical methods and point schemes for evaluating fire safety. Fire as a system. Costs of fire prevention, protection and accomodation. Approaches to value of investment for protecting life and avoiding disturbance to the community. Business interruption and consequential loss. Hazard analyses. Fault tree and success tree models. Cost effectiveness, optimisation and trade off. Extreme value theory. Risk theory).

MANAGEMENT OF FIRE SAFETY. (Special problems concerned with industrial processes and storage areas (e.g. chemical, petroleum, energy industries). Protection of high rack storage and data processing equipment. Fire safety in transport by land, air and sea, including transport through tunnels and transport af hazardous loads. International requirements for transport. Function of Fire Safety Managemers and Administrators. Development of manuals and codes for fire safety. Day to day management of risk. Inspection and safety check procedures. Education for fire safety and attitudes of work force and public towards safety requirements. Aspects of management of Fire Services and Fire Insurance Activities).

Fire research activities with relation to Fire Engineering Education

MAIN RESEARCH PROJECTS	SPONSOR
Pressurisation as a Smoke Containment in Buildings	Science Research Council
Prediction of Fire Behaviour Combustible Materials as used in Buildings	Science Research Council
Fault Tree Analysis of Hospital Fire Safety Problems	Department of Health and Social Security
Towards a Predictive Specification for Concrete Filled Hollow Steel Columns	British Steel Corporation
Smoke Load Survey in Hospitals	Department of Health and Social Security
Points Scheme Fire Safety Evaluation for Hospital Buildings	Department of Health and Social Security
Fire Safety and the Architect	PhD Study
Fire Safety of Offshore Oil Production Platforms	PhD Study

MSc RESEARCH PROJECTS

The hazard of heat and humidity to firefighters.

A systematic approach to life assessment.

Ignition conditions for combustible materials.

Propensity to ignition of carpet backing materials.

Smoke production from burning materials.

Hazard analysis of a Horton sphere.

Recovery from the effects of fire in industry.

The cost-effectiveness of automatic fire detection systems with special reference to hotels.

An evaluation of the role and design of pumping appliances in the Hampshire Fire Brigade.

Study of fire safety at maternity unit of Simpson's hospital.

Operation of smoke detectors by combustion products travelling by natural convection along a duct.

A study of natural ventilation of a smoke filled compartment.

The extinction of diffusion flames by halons in atmospheres of varying oxygen/nitrogen concentrations.

Fault tree analysis for the operation of a liquefied gas marine terminal.

Ignition and extinction of combustible surfaces.

The design of concrete structures for fire resistance.

Assessment of fire safety of manufacturing industries.

Smoke production from the flaming combustion of materials.

Explosibility of turbulent vapour and dust mixtures in the Hartmann bomb.

Audibility of alarms.

Dynamics of sprays produced by sprinkler heads.

An assessment of two strategies for reducing domestic fire fatalities.

A hazard analysis of the bulk transportation of liquified petroleum gas by road and rail within the United Kingdom.

The determination of mass flux under critical conditions.

Convective heat transfer towards extinction.

Available textbooks, notes, collection of problems, examination papers, etc. specially prepared for the fire-educational activities at the institution

Notes and problem sheets are issued to students but are not available generally.

Special publications concerning the fire-educational activities at the institution

DEPARTMENTAL DOCUMENTS AND PUBLICATIONS AVAILABLE

Proceedings of International Symposium "Fire Safety of Combustible Materials".
Fire Safety for the Handicapped.
D.J. Rabash and D.D. Drysdale, "Report on Fire and Explosion Hazard to Dalgety Bay and Aberdour Associated with the Proposed Fife NGL Plant".
Copies of summaries of papers given at most of the short courses that have been run by the Department (Annex I) are available on request for a nominal charge.
The full content of the Fire Safety Management Course is being prepared for pub-

lication and this will be available within the next few months.
Steps are being taken also to publih the full content of the specialist course on Smoke Control in Buildings.

Supplementary remarks

Activities of the Department other than full time teaching

LIST OF COURSES HELD

Principles of Fire Processes	November 1973
Fire Properties of Combustible Solids	January 1974
Quantitative Approaches to Fire Risk Management	April 1974
Effects of Fires on Structures	June 1974
Escape Route Design and Smoke Control in Buildings	July 1974
Sources of Ignition	October 1974
Automatic Detection and Fixed Installations	December 1974
Fire Safety for the Handicapped	March 1975
Fire Safety Management	April 1975
Fire Safety of Combustible Materials (International Symposium)	October 1975
Fire Safety and Tall Buildings	March 1976
Fire and Explosion Safety in the Chemical Industry	March 1976
An Appraisal of Modern Firefighting Techniques and Resources	June 1976
Fire Safety in Ships	October 1976
Smoke Control in Buildings	April 1977
Appraisal and Measurement of Fire Safety	October 1978
Fire Properties of Combustible Solids	Jan/Feb 1979
Fire Safety Design of Structures	June 1979
Smoke Control in Buildings	October 1979
Fire Safety in the Production and Transport of Liquid and Gaseous Fuels	December 1979
Fires in Buildings with Particular Reference to Fire Investigation	March 1980

During the same period the members of staff of the department have published some 46 papers and articles.

TECHNICAL CHAMBER OF GREECE GR

Name and address of the institution

Technical Chamber of Greece
4 Karageorgi Serbias St.
Athens 125
Greece

Members of the staff involved in fire-educational activities

George M. Kalos, Civil Engineer
(contact address: 1. Gladstonos St., Athens 141, Greece).

Kyriakos Papaïoanou, Civil Engineer
Faculty of Civil Engineering
University of Salonica
(contact address: 21 Dodecanisou St., Salonica, Greece).

Summary of the general education system with special reference to activities within the field of Fire Technology and Fire Engineering

The Technical Chamber of Greece is a non-profit Professional Organization of all the engineers of Greece, educated on University level (civil, mechanical, and electrical, topography, mining and metallurgy, chemical engineers and architects).

Among its aims are the promotion of the level of construction and of knowledge, related to the former. In this frame it is organizing lectures and seminars for its members, in which specialists, from Greece and from abroad, are handling special topics.

One such seminar, the first of this kind in Greece, was for Fire Protection. It took place in Athens between the 12th November and the 20th December 1977 and was attended by 120 graduated engineers, employed in the erection and operation of industrial plants (structural engineers, mechanical and electrical, and chemical engineers).

A second seminar is planned for November 1980 (see the next page).

Educational activities within the field of Fire Technology and Fire Engineering

The courses comprised 12 lectures of 3 hours each with intervals of 20' of film projection, as follows:

1. Theory of combustion and extinguishment of fires.
2. Passive (or structural) fire protection.
   a. The development of fire in buildings: growth, burning and decay periods. Thermal load, ventilations' conditions.
   b. Forecast of temperatures' development in the fire cell and building elements.
   c. Compartmentation of buildings against fire spread.
   d. Behaviour of building materials and elements in fire.
   e. Protective coatings and membranes.
3. Permanent systems of fire extinguishment
   a. Systems using water: hydrants - sprinklers.
   b. Systems with foam
   c. Systems with powders (for small distances of pipes).

d. Systems with CO_2
e. Systems with HALON

4. Fires in industrial plants: some special cases and problems.
   a. Fires in the proximity of electrical cables.
   b. Fire stopping of canalisations.
   c. After-fire activities.
5. Fire extinguishing with water.
6. Sprinkler systems.
7. Active fire protection: Fire detectors, fire alarms.
8. Mobile extinguishing equipment.
   Types of extinguishers, sizes. (Water, foam, "light water", powder, CO_2, Halon). Criteria for the selection of type and size.
9. Fires in "high piled storages", and the use of sprinklers therein.
10. First aids to persons affected in fires. Psychological problems.
11. Fires in fuel storage (liquid fuels).
12. The activity and disponible means of the fire brigades in Greece.

Two seminars are now planned for the end of this year (1980), one for architects and civil engineers, and one for mechanical, chemical and electrical engineers.

The programme of the seminar for architects and civil engineers is containing the items 1, 2 (a.....e.), 3.a., 4.b., 7, 10, 12 of the first seminar as above, plus discussion on the fire protection requirements of the new Building Code: Life safety requirements, i.e. escape routes, fire and smoke spread control.

The programme of the seminar for mechanical, chemical and electrical engineers contains the items 1, 2 (a. and b.), 3, 4, and 5 to 12 of the first seminar plus elements about the behaviour of plastics in fires.

UNIVERSITÀ DEGLI STUDI DI NAPOLI I

Name and address of the institution

Tecnica delle Costruzioni
Universitá degli Studi di Napoli
Piazzale Tecchio
Napoli
Italy

Members of the staff involved in fire-educational activities

Prof. Dr.Ing. Salvatore Cuomo, guest lecturer (contact adress:
Via E. Nicolardi - Parco Arcadia n. 7, 80131 Napoli, Italy)

Summary of the general education system with special reference to activities within the field of Fire Technology and Fire Engineering

At the university - and other italien universities - there don't exist regular courses concerning Fire Technology, as the scientific and technical principles on which they are based are treated in various subjects as Chemistry, Technical Physics, Fluid Dynamics, Gas Dynamics, Heat Transfer and Strength of Materials.

Two times (in 1966/67 and 1967/68) "free courses" on Fire Resistance of Materials and Structures have been kept at the Architectural Institute of the university, each of 20 hours' duration.

Educational activities within the field of Fire Technology and Fire Engineering

COURSE: FIRE RESISTANCE OF MATERIALS AND STRUCTURES (20 HOURS' LECTURES)

Fires. Duration, temperature radiation, materials' reaction to fire, fire resistance of structures, characteristic temperature/time-curves, fire testing methods, temperature measuring.
Reaction to fire of construction materials; experimental determination. Natural and artificial stones, concrete, metals, wood, glass, coverings and flooring materials.
Fire resistance of structures; experimental control. Walls, fire-sectional walls, pilasters and columns, floorconstructions, roofconstructions and coverings, staircases and lifts, supplementing constructions, finishings.
Protection of non fire-resistant materials and testing of effiency of protection meterials.
Calculation methods of rupture (ideal elast-plastic) and their applications to prediction of fire resistance of structures. Experimental investigations of fire resistance of structures and entire buildings.

Available textbooks, notes, collection of problems, examination papers, etc. specially prepared for the fire-educational activities at the institution

Salvatore Cuomo: Elementi di resistenza al fuoco delle struttore d'acciaio e lore protezione. Napoli 1975.

Supplementary remarks

The above mentioned textbook contents subjects treated at free courses at the University of Genova and information courses yearly kept by means of the Engineers' Orders of various provinces.

In Italy regular courses on Fire Technology are kept at Fire Central School at Campanella - Roma, to Firemen Officers who have a degree in Engineering.

KYOTO UNIVERSITY

J

Name and address of the institution

Department of Architectural Engineering
Faculty of Engineering
Kyoto University
Sakyo-ku, Yoshida, Kyoto
Japan

Members of the staff involved in fire-educational activities

Toshio Terai	Dr. of Eng.	Associate Professor
Takashi Tanaka	Dr. of Eng.	Associate Professor
Masami Kobayashi	Dr. of Eng.	Assistant

Summary of the general education system with special reference to activities within the field of Fire Technology and Fire Engineering

At Kyoto University, the educational activity of fire engineering is offered in the department of Architecture, faculty of Engineering.

All students of Kyoto University must take the two-year of liberal arts course and learn foundamental subjects as cultural science, social science, foreign language and natural science (mathematics, physics, chemistry, etc.) in the liberal arts department. After this liberal arts course, they take two-year of specialized course in each department to obtain a bachelor-degree.

The architectural students can learn the introduction of structural engineering, architectural design and environmental engineering even in the liberal arts course, but the subjects concerning fire engineering are lectured only in the specialized course of architectural department. They are subjects of "Behavior in Architecture" and "Fire Engineering" and lectured in the first semester (one year is divided into two semesters) for two hours per week as optional subjects.

Educational activities within the field of Fire Technology and Fire Engineering

BEHAVIOR IN ARCHITECTURE ---------- (ONE SEMESTER, TWO HOURS PER WEEK)

Human behavior in fire situation.
Evacuation planning of buildings.

FIRE ENGINEERING ---------- (ONE SEMESTER, TWO HOURS PER WEEK)

Physical and chemical phenomena of building fire.
Fire prevention and protection of building.
Regional planning against conflagration.
Systems approach to fire safety.

Fire research activities with relation to Fire Engineering Education

Systems analysis of fire safety in building.
Smoke movement and growth of fire in compartment.
Human behavior in buildings under fire.

Available textbooks, notes, collection of problems, examination papers, etc. specially prepared for the fire-educational activities at the institution

"Fire Prevention and Protection of Building" written by Dr. S. Horiuchi.

SCIENCE UNIVERSITY OF TOKYO NODA CAMPUS J

Name and address of the institution

Department of Architecture and Building Engineering
Science University of Tokyo
Noda-shi, Chiba-ken
Japan

Members of the staff involved in fire-educational activities

K. Kawagoe, Professor Dr. (Eng.)

Summary of the general education system with special reference to activities within the field of Fire Technology and Fire Engineering

Science University of Tokyo (Tokyo Rika Daigaku) has four Undergraduate Divisions and four Graduate Divisions of Science, Pharmaceutical Science, Engineering and Science & Technology commenced in April.

In ten departments in Undergraduate Division of Science & Technology in Noda Campus in Chiba-ken, there is The Department of The Architecture and Building Engineering for four years Bachelor Course.

In the Graduate School there is five years Doctor Course in Department of Architecture & Building Engineering in Noda Campus.

In these departments there are several courses of fire engineering.

Educational activities within the field of Fire Technology and Fire Engineering

THE COURSE OF FIRE ENGINEERING I (TOTAL 20 HOURS, 1.5 HOURS PER WEEK)

This course is offered in the first term of the third year (5. semester). Students of about 130 must choose this course which includes the basic knowledge of fire engineering such as the behaviour of compartment fire, smoke movement, compartmentation of building, detection and suppression system, mean of egress, etc.

THE COURSE OF FIRE ENGINEERING II (TOTAL 20 HOURS, 1.5 HOURS PER WEEK)

This course is offered in the latter term of the third year (6. semester). The student is free to choose this course which includes the structural aspect of fire resistance and the behaviour of conflagration of wooden city. About the half of the students usually choose this course.

THE PROJECT RESEARCH COURSE

In the fourth year the student has to choose the half year (7. semester) or the full year (7. + 8. semester) course of project research relating with any building design or engineering problem. Usually 10-15 students make the fire research project of experimental or theoretical work.

THE SPECIAL COURSE OF FIRE ENGINEERING (TOTAL 40 HOURS, 1.5 HOURS PER WEEK)

This course is offered in every two years for the advanced students of about 20 who are free to choose several courses including the fire engineering. About the half of the students choose this course.

Fire research activities with relation to Fire Engineering Education

Experimental study on the behaviour of compartment fire.
Experimental study on the behaviour of furniture fire.
Experimental study on the smoke movement in buildings.
Statistic study on the growth of fire.

Available textbooks, notes, collection of problems, examination papers, etc. specially prepared for the fire-educational activities at the institution

Fire Protection Text Book (KENCHIKU BOKA KYOZAI) edited by The Japanese Association of Fire Science and Technology.

SCIENCE UNIVERSITY OF TOKYO KAGURAZAKA CAMPUS J

Name and address of the institution

Science University of Tokyo (Tokyo Rika Daigaku)
1-3 Kagurazaka
Shinjuku-ku
Tokyo
Japan

Members of the staff involved in fire-educational activities

Tetsuo Moriwaki, Dr. of Eng., Professor
Toshio Eda, M. of Eng., Assistant

Summary of the general education system with special reference to activities within the field of Fire Technology and Fire Engineering

The history of Science University of Tokyo (Tokyo Rika Daigaku) dates back to 1881, when the founders opened Tokyo Butsurigaku Koshusho (Tokyo School of Science), the predecessor of the present University.

The founders were the first nineteen bachelors of science that had been produced in Japan between 1878 and 1880 by the Tokyo Imperial University (now the University of Tokyo) and their two cooperators. They opened the school with a view to making a contribution to the spread and development of science, which at that time was rather neglected, while politics, economics and other social sciences were highly regarded in the eagerness to improve the political, social and economic conditions of the country.

Building up sound academic traditions and expanding the student enrollment during the nearly one hundred years of its existence, the University has acquired an unshakable academic prestige and is now one of the most outstanding universities of science and technology in Japan.

Organization

The University comprises a graduate school of four divisions:

Division of Science	(3 departments)
Division of Pharmaceutical Sciences	(1 department)
Division of Engineering	(3 departments)
Division of Science and Technology	(7 departments)

and 6 undergraduate faculties:

Faculty of Science	(6 departments)
Faculty of Pharmaceutical Sciences	(2 departments)
Faculty of Engineering	(5 departments)
Faculty of Science and Technology	(10 departments)
Faculty of Science (Evening Division)	(3 departments)
Faculty of Engineering (Evening Division)	(3 departments)

Admission

Undergraduate admission. Students who have completed a senior high school course, 12 years of regular school work, or its equivalent and who have passed the University Entrance Examination may be admitted to the first year of study in one of the 29 departments of Science University of Tokyo.

Graduate admission. Students who have completed a four-year college or univer-

sity course, 16 years of regular school work, or its equivalent and who have passed the University Entrance Examination may be admitted to the first year of postgraduate study in one of the 14 departments of the Graduate School of Science University of Tokyo.

Degrees

The degrees awarded by the University are:

Bachelor of Science (Rigakushi)
Bachelor of Engineering (Kohgakushi)
Bachelor of Pharmaceutical Sciences (Yakugakushi)
Master of Science (Rigaku-shushi)
Master of Engineering (Kohgaku-shushi)
Master of Pharmaceutical Sciences (Yakugaku-shushi)
Doctor of Philosophy in Science (Rigaku-hakushi)
Doctor of Philosophy in Engineering (Kogaku-hakushi)

Credit system

Four credits for a lecture (a practice) of two (four) hours per week for a term of thirty weeks.

Need credit:

subject	credit
general subjects	36
foreign language	16
helth and physical education	4
technical (professional) education	89
The period of attendance at school	$\geq$ 4 years

Fire Technology and Fire Engineering

Within the engineering education system Fire Technology is located on

a) Department of Architecture (Division of Engineering of the Graduate School)
b) Department of Architecture (Faculty of Engineering, Undergraduate Faculty)

There are eighty students on each grade in the Department of Architecture, Undergraduate Faculty.

Subjects in the field of Fire Technology and Fire Engineering:

1) Fire science of architecture (4 credits, at third grade).
2) Practice of fire engineering (A part in Practice of Structure, at third grade).
3) A student should select one of the following seminars at the last grade: Design, Environmental Engineering, Structural Engineering, Fire Engineering.
   Fire Engineering seminar has the following areas: Building fire, Evacuation at the building fire, Fire spread in the city, Refuge, Area of refuge.
   The student researches for a year into the subject that he selects.

Educational activities within the field of Fire Technology and Fire Engineering

COURSE: FIRE SCIENCE OF ARCHITECTURE

This lecture has thirty times for a year, and each time spends two hours (4 credits).

Statistics of fire: An outline of fire with statistics and examples.

Combustion: A principle of combustion and about a material combustion.

Behaviour of material in high temperature: About a gas and a smoke which are produced by material in high temperature. And about Mechanical behaviour of materials in high temperature.

Compartment fire: Flame and temperature, Flash-over, Fire growth period (Intensive stage of fire), Radiant heat, Outflow gas.

Prevention of fire spread: Fire resistance of fire shutter and fire wall.

Endurance of building structure against fire: Fire resistance of building construction.

Smoke protection: Behaviour of smoke and smoke control.

Evacuation: Fire escape planning in a building.

City fire: Lecture of urban great fire and urban fire prevention.

Code.

Fire research activities with relation to Fire Engineering Education

Efficiency of Partition against fire.

Human Behaviour in the Beginning of Fire (before starting escape).

Fire safety of building.

Reliability of flame retardance of wallpaper.

Urban fire protection.

Available textbooks, notes, collection of problems, examination papers, etc. specially prepared for the fire-educational activities at the institution

「建築防火教材」 "Fire Protection Textbook", Japanese Association of Fire Science and Engineering (JAFSE).

NORGES TEKNISKE HØGSKOLE N

Name and address of the institution

Institut for Husbyggingsteknikk,
Norges tekniske Høgskole,
7034 Trondheim NTH
Norway

Members of the staff involved in fire-educational activities

Professor, Dr.ing. Esben Thrane, affiliated professor

Summary of the general education system with special reference to activities within the field of Fire Technology and Fire Engineering

Traditional "Hochschule" german model. Fire Engineering is given as one of many choises in 4th year, and postgraduate.

Educational activities within the field of Fire Technology and Fire Engineering

Fire Engineering is given as a part of basic course in building technology in 3rd year (6 lectures).

Fire Engineering is given as a part of advanced course in building technology in 4th year (16 lectures).

Fire Engineering is given as a postgraduate course leading to dr.ing.

Fire research activities with relation to Fire Engineering Education

None on a systematic basis. Some on a ad hoc basis.

Available textbooks, notes, collection of problems, examination papers, etc. specially prepared for the fire-educational activities at the institution

Two textbooks under preparation. One to be issued in 1980.

DELFT UNIVERSITY OF TECHNOLOGY NL

Name and address of the institution

Delft University of Technology
Department of Civil Engineering
Stevinweg 1
Delft
Netherlands

Members of the staff involved in fire-educational activities

Prof.Ir. J. Witteveen
in close co-operation with the staff of:
INSTITUTE TNO for Building Materials and
Building Structures
Lange Kleiweg 5
Rijswijk
Netherlands

Summary of the general education system with special reference to activities within the field of Fire Technology and Fire Engineering

The department of Civil Engineering of Delft University of Technology offers a curriculum of 5 years (= 10 semesters) leading to a degree in Civil Engineering, equivalent to M.Sc. in Anglo-Saxon countries.

- 4 semesters basic sciences equal for all civil engineering students.
- 3 semesters advanced courses in basic sciences for all civil engineering students and special courses in civil engineering subjects for the different branches, such as Hydraulic Engineering, Building Structures, Sanitary Engineering, Planning etc.
- 3 semesters with advanced courses in civil engineering subjects directed to the different branches. It includes also the final examination project which normally consists of a design project, or theoretical and experimental research-work, within the respective branches of civil engineering.
- The civil engineering degree gives entrance to a Ph.D.-degree in Technical Science.

Apart from information on material properties at elevated temperatures in material courses, courses in Building Physics, Heat Transfer and Combustion, no special courses in Fire Technology and Fire Engineering Design are given.

Educational activities within the field of Fire Technology and Fire Engineering

- In courses on Concrete Construction, Steel Construction and Timber Construction, the behaviour under fire action is briefly summarized.
- In a course Advanced Plastic Analysis and Design approximately 4 hours are devoted to fire engineering design of steel and concrete structures.
- Fire aspects of the building regulations, fire testing and classification of building materials and construction are not covered in regular courses, but are sometimes dealt with in design projects of individual students or groups.
- For a limited number of students (appr. 2 per year) their final examination project lies in the field of fire engineering research. These students work during the last two semesters as a research assistant at the Institute TNO

for Building Materials and Building Structures. During the last 5 years the subjects are on fire behaviour of steel and concrete structures.

- Regularly two civil engineers are working on a Ph.D.-degree in a fire engineering subject.
- A postgraduate course for architects and consulting engineers is offered approximately each two or three years (36 hours with a participation of appr. 60).

Fire research activities with relation to Fire Engineering Education

Students co-operate as student-assistants in research work at the Institute TNO for Building Materials and Building Structures.

Available textbooks, notes, collection of problems, examination papers, etc. specially prepared for the fire-educational activities at the institution

Text-book: Fire Safety of Steelstructures - 1966 (in Dutch), revised 1978.

Fire Safety in Buildings, textbook for a postgraduate course 1975.

Examination-papers: Numerous examination papers, which are mostly used as a basis for research publications.

TECHNISCHE HOGESCHOOL EINDHOVEN NL

Name and address of the institution

Department of Architecture
University of Technology
5600 MB Eindhoven
Netherlands

Contact: Prof.ir. P.A. De Lange

Members of the staff involved in fire-educational activities

ir. B.G. Wolfs

Summary of the general education system with special reference to activities within the field of Fire Technology and Fire Engineering

Lessons Building Technology 28 h. Within this course 6-8 h. about Fire Technology.

Within the examination 1 or 2 problems in the field.

Library-activities:
30-40 books on the subject.
1 periodical.

Educational activities within the field of Fire Technology and Fire Engineering

Lessons with reference to Dutch Standards.
Text-book on the subject.
About once a year a special lesson by a research-man.

Fire research activities with relation to Fire Engineering Education

Only desk-research.

Available textbooks, notes, collection of problems, examination papers, etc. specially prepared for the fire-educational activities at the institution

Brandprevente (textbook) (70 pag.) (fire-protection).

Question-book with building-technology problems.

LUND UNIVERSITY S

Name and address of the institution

Division of Structural Mechanics and Concrete Construction
Lund Institute of Technology
Fack 725
S-220 07 Lund 7
Sweden

Members of the staff involved in fire-educational activities

O. Pettersson	Dr.Techn., Professor
Y. Anderberg	Dr.Techn.
S.E. Magnusson	Dr.Techn.
S. Thelandersson	Dr.Techn.
U. Wickström	Dr.Techn.
B. Fredlund	M.Sc.

Summary of the general education system with special reference to activities within the field of Fire Technology and Fire Engineering

The division forms a part of the civil engineering department of the technical university in Lund. The educational system is a nominally four-year one, leading to the degree of Master of Science (Bachelor of Science?). The educational system is traditionally structured with a number of mandatory basic courses which the student has to supplement with additional courses, chosen with regard to the area of specialization. At present, the curriculum on the basic level offers no courses specifically within the area of fire safety technology.

Educational activities within the field of Fire Technology and Fire Engineering

I Basic level

The average civil engineering student encounters the subject of building fire-safety mainly in a course on load-bearing structures. In ten hours of lectures the following topics are covered

- principles of design of fire-exposed building components
- fire load statistics, process of fire development, load-carrying capacity
- practical design exercises for some simplified cases.

II Ph.D. level

During 1977 a seven week, postgraduate course was offered in the area of building firesafety engineering. The number of participants were eleven, most of them from other research organizations outside Lund. The following areas were among those covered

- goal-oriented design systems and models
- models of pre-flashover compartment fires
- models of fully-developed compartment fires
- models of firespread in low-rise housing areas
- computational models of transient, fire-induced temperature-fields in building components

- load-carrying capacity of fire-exposed building components (steel, concrete, wood)
- safety evaluation techniques, including decision-tree analysis, probabilistic models
- fire insurance and fire damage analysis.

III Single courses

Outside the ordinary curriculum the university offers the students a number of "single courses" thought to be of interest to more than one department or faculty. One such course is "Building Firesafety", comprising 12 hours of lectures and 20 hours of seminar discussion. In principle, the topics under section II will be covered, though on a less advanced level.

Fire research activities with relation to Fire Engineering Education

A number of examination projects (>10) have been carried out over the years in the area of building firesafety.

HELSINKI UNIVERSITY OF TECHNOLOGY SF

Name and address of the institution

HELSINKI UNIVERSITY OF TECHNOLOGY
Tekniska Högskolan i Helsingfors
Institutet för Konstruktionsteknik
Byggnadingenjörsavdelningen
Rakentajainaukio 4
SF - 02150 Espoo 15
Finland

Members of the staff involved in fire-educational activities

Vesa Penttala	Acting Assoc.prof.
Martti Viljanen	Dipl.Ing.

Educational activities within the field of Fire Technology and Fire Engineering

Course 7.43.14 Building Physics 2 weeks work

Fire research activities with relation to Fire Engineering Education

Diplomawork in the laboratory of Statens Tekniska Forskningscenter (VTT).

WORCESTER POLYTECHNIC INSTITUTE USA

Name and address of the institution

Center for Firesafety Studies
Worcester Polytechnic Institute
Worcester, MA 01609
USA

Members of the staff involved in fire-educational activities

Professor David A. Lucht, Director
Professor Robert W. Fitzgerald

Summary of the general education system with special reference to activities within the field of Fire Technology and Fire Engineering

Worcester Polytechnic Institute, founded in 1865, is the third oldest college of engineering and science in the United States. The university is committed to a completely new philosophy of undergraduate education for engineering, scientific, managerial and public service professions. The goal of the Worcester Polytechnic Institute is as follows:

By means of coordinated programs tailored to the needs of the individual student, it is the fundamental purpose of WPI to impart to students an understanding of themselves, and the needs of the people around them. WPI students, from the beginning of their undergraduate education, should demonstrate that they can learn on their own, that they can translate their learning into worthwhile action, and that they are thoroughly aware of the interrelationships among basic knowledge, technological advance, and human need. A WPI education should develop in students a strong degree of self- confidence, an awareness of the community beyond themselves, and an intellectual restlessness that spurs them to continued learning.

To achieve this goal, the educational program is performance based. Among the requirements, project work plays a major role in the WPI experience. Over the past few years, many projects have been undertaken in various aspects of fire protection. Some recent topics include:

- Fire department pre-planning and manpower studies
- Building code and firesafety standards analysis
- Building firesafety analyses
- Evaluation of fire testing and structural response to elevated temperatures
- Fire investigation and arson analysis

A natural extension of these undergraduate activities has been the establishment of a graduate program in fire protection engineering. This Master of Science program in fire protection engineering was initiated in 1979.

Like other curricula at WPI, the Master of Science degree program in fire protection engineering is designed to be flexible enough to meet specific and varying student educational objectives. Students can select combinations of major courses, non-major courses, and thesis topics which will prepare them to proceed in the career directions they desire. The curriculum can be tailored to enhance knowledge and skill in the general practice of fire protection engineering; or in fire protection engineering "specialties" (such as industrial, chemical,

energy, power); or in the more theoretical and research-oriented sphere.

The curriculum will generate fire protection engineer graduates who are capable of working productively in the existing job market as well as those who might wish to devote their careers to longer-term basic and applied research and teaching. It provides BSFPE graduates an opportunity to advance their studies, and it offers a mechanism for holders of degrees in other disciplines to obtain more formal education in fire sciences.

The MSFPE program at WPI is administered by the Fire Protection Engineering Committee, chaired by the Director of the Center for Fire-safety Studies. During its initial years, fire protection engineering graduate courses will only be offered in the evening division. It is hoped that, as time goes along, a full-time day program will emerge. It should be pointed out, however, that it is not required that all courses be taken at night on the WPI campus. Day courses can also be taken for credit at WPI, and credit can be transferred from other universities.

DEGREE REQUIREMENTS

The Degree of Master of Science is granted to students who fulfill the following requirements: a minimum of 30 semester hours of graduate work completed with an average of B or better; of the 30 hours, a minimum of 20 hours must be graduate level course, and 15 hours must be in the field of fire protection engineering. Other courses may be chosen from advanced undergraduate courses approved by the Fire Protection Engineering Committee. A grade of C or better must be earned in all courses offered in fulfillment of these requirements. A graduate student may be ineligible for further study if that student's cumulative quality point average falls below 2.9 (A = 4.0), and the appropriate officials recommend such action.

Credits may be transferred from other schools to partially satisfy degree requirements; however, a minimum of 20 credits must be earned at WPI.

A thesis may or may not be required, depending on the student's specific educational objectives. Thesis work normally receives 6 semester hours of credit.

An academic year at WPI includes 2 semesters of approximately 14 weeks duration each. Nominally a 3 semester hour course would include 3 classroom hours per week. Tuition fees for the 1979-1980 academic year are $120 per semester hour for credit courses.

ENTRANCE REQUIREMENTS

The basic requirement for entrance to the Master of Science curriculum is a Bachelor's degree from an accredited institution in a relevant field of science or engineering. Those entering the curriculum must also provide evidence that they have acquired a basic understanding of fire protection engineering fundamentals. Those who have obtained the BSFPE degree will normally satisfy this requirement. For those with other degrees, relevant fire protection engineering experience may be sufficient for unconditional admission. For others, certain prerequisite courses may be required. WPI plans to develop self-instructional materials for this purpose.

Admission to a course or courses and satisfactory completion of those courses does not constitute acceptance as a candidate for the Master's degree.

Admission to Candidacy for the Master's degree may be granted after some graduate work has been completed and the student's program and course performance have met appropriate criteria.

Educational activities within the field of Fire Technology and Fire Engineering

FIRE PROTECTION ENGINEERING COURSES

As mentioned earlier, the specific courses to be taken by any individual student will depend on his or her specific educational objectives. Specific major FPE courses will develop and change as time goes along. At the present time, 11 course titles have been identified. These are described below. Seven of these are graduate degree credit courses and four are anticipated to be available for prerequisite study, professional development, or self-improvement on a non-credit basis. In addition to the 11 course titles are a credit course on special problems (FPE 580), a seminar course (FPE 581), and the thesis (FPE 590).

GRADUATE FPE COURSES

All FPE courses carry 3 hours of credit, unless otherwise specified.

FPE 521. FIRE DYNAMICS

The physics, chemistry, and dynamics of fire behavior. Topics include fire properties of gases, liquids, and solids; heat transfer; products of combustion; fire spread; fire effects; explosions. Emphasis is placed on the dynamic aspects of fire phenomena.

FPE 522. RISK EVALUATION

Evaluation of risks such as those encountered in manufacturing operations, chemical production, energy production, storage, and transportation. Emphasis is placed on the assessment and management of risk.

FPE 551. FIRE PROTECTION SYSTEMS

The design and evaluation of systems and devices to sense, control, extinguish, or confine unwanted fire. The influence of installation, reliability, and maintenance is integrated into design decisions. Emphasis is placed on the evaluation of standards.

FPE 561. FIRE AND CASUALTY INSURANCE PRACTICES

Financial risk management and decision-making from an industrial/commercial management viewpoint. Insurance rate-making, adjustment, and policies as factors in making engineering economic decisions.

FPE 562. FIRE PROGRAM MANAGEMENT

The management of community and private fire protection programs. Emphasis is on the assessment of needs, planning, organization, and evaluation.

FPE 571. ENGINEERING BUILDING FIRESAFETY

Analysis and design of buildings for firesafety using hazard analysis and incorporating specific firesafety strategies into a systems methodology. Both compartmented and non-compartmented buildings will be designed for criteria of life safety, property protection, continuity of operations, operational management, and cost.

FPE 572. FAILURE ANALYSIS

The reconstruction of fire incidents. Emphasis is placed on organization and techniques of scientific failure analysis including fire behavior, equipment performance, code effectiveness, and building research.

FPE 580. SPECIAL PROBLEMS

Individual or group studies on any phase relating to fire protection may be selected by the student and approved by the faculty member who supervises the work.

FPE 581. SEMINAR

Reports on current advances in the various branches of fire protection.

FPE 590. THESIS

(6 hours credit) Research study at the MS level.

NON-CREDIT PROFESSIONAL DEVELOPMENT COURSES

ANALYTICAL TOOLS

The study of fundamental analytical techniques applicable to fire protection engineering; fire data analysis, probability, statistics, systems analysis, mathematical and computer techniques.

FIRE PROTECTION SYSTEMS & DEVICES

The study of fire protection basics as they relate to hardware, systems, and devices. Automatic water suppression systems, special hazard systems, detectors, smoke control, fire department apparatus.

BUILDING DESIGN & CONSTRUCTION

The study of fire protection basics as they relate to building design and construction; fire resistance, material flame spread characteristics, combustibility, smoke production, opening protection, exit systems, exposure.

CODES, STANDARDS, & PRACTICE

The study of fire protection basics as they relate to the interpretation, use and management of contemporary fire and building codes and technical standards.

Supplementary remarks

APPLYING FOR ADMISSION

As mentioned earlier, the MSFPE curriculum at WPI is a new educational effort. Considerable time will be required for this curriculum to mature and reach a steady-state operation. However, interested students may apply now for admission to the Master of Science program in fire protection engineering. For further information about Worcester Polytechnic Institute, the Master of Science degree program, and application procedures, please contact:

Professor David A. Lucht
Director, Center for Firesafety Studies

or

Professor Robert J. Hall
Director of Continuing Education

Worcester Polytechnic Institute
Worcester, Massachusetts 01609

telephone (617) 753-1411

UNIVERSITY OF MARYLAND — USA

Name and address of the institution

Department of Fire Protection Engineering
University of Maryland
College Park, Maryland 20742
United States of America

Members of the staff involved in fire-educational activities

Full time:
John L. Bryan, D.Ed.
Harry E. Hickey, Ph.D.
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Part time:
W.D. Walton, M.Sc.

Summary of the general education system with special reference to activities within the field of Fire Technology and Fire Engineering

STRUCTURE OF ENGINEERING CURRICULA. Courses in the normal curriculum or program and prescribed credit hours leading to the degree of Bachelor of Science (with curriculum designation) are outlined in the sections pertaining to each department in the College of Engineering. No student may modify the prescribed number of hours without special permission from the dean of the college. The courses in each curriculum may be classified in the following categories:

1. Courses in the General University Requirements: An engineering student must include 18 credits of humanities and social sciences in the program of general studies.
2. Courses in the physical sciences: Mathematics, Chemistry, Physics.
3. Collateral engineering courses: Engineering sciences, and other courses approved for one curriculum but offered by another department.
4. Courses in the major department: A student should obtain written approval for any substitution of courses from the department chairman and the dean of the college.

The courses in each engineering curriculum, as classified above, form a sequential and developmental pattern in subject matter. In this respect, curricula in engineering may differ from curricula in other colleges. Some regulations which are generally applicable to all students (see the Academic Regulations) may need clarification for purposes of orderly administration among engineering students. Moveover, the College of Engineering establishes policies which supplement the University regulations.

BASIC FORMAT OF THE FRESHMAN-SOPHOMORE YEARS IN ENGINEERING. The freshman and sophomore years in engineering are designed to lay a strong foundation in mathematics, physical sciences and the engineering sciences upon which the student will later develop a professional program during the upper division (junior and senior) years. The College course requirements for the freshman year are the same for all students, regardless of their intended academic program, and about 75% of the sophomore year course requirements are common, thus affording the student a maximum flexibility in choosing a specific area of engineering specialization. Although the engineering student selects a major field at the start of the sophomore year, this intramural program commonality

affords the student the maximum flexibility of choice or interdepartmental transfer up to the end of the sophomore year.

GENERAL COLLEGE REQUIREMENTS FOR THE FRESHMAN AND SOPHOMORE YEARS

	Credit Hrs.
A. General Univ. Requirements	15
B. Mathematics Four courses in mathematics are required to be selected from MATH 140, 141, 240, 241 and 246.	15
C. Physical Sciences A minimum of 19 credit hours in Physics and Chemistry must be completed, with not less than seven (7) in either field.	19
D. Engineering Sciences Nine (9) credit hours must be completed in the Engineering Sciences, to be selected from ENES 101, ENES 110, ENES 220 and ENES 221. Each is a three (3) credit hour course.	9
E. Engineering Sciences, Mathematics, Physical Sciences or Major Field Engineering Eight (8) credit hours to complete the freshman-sophomore year requirements may be in any of the fields indicated, but no more than six (6) credit hours may have a major field designation.	8
Total Minimum Academic Credits in freshman-sophomore years	66

JUNIOR-SENIOR REQUIREMENTS FOR THE DEGREE OF B.S.-ENGINEERING

Requirements	Engineering Option	Applied Science Option
General Univ. Requirements	15 sh.	15 sh.
Mathematics, Physical Sci. requirements[3]	3 sh.	3 sh.
Engineering Sciences[1,3]	6 sh.[2]	6 sh.
Primary Field[4]	24 sh.(Engr)	18 sh.(Engr)
Secondary Field	12 sh.(Engr)	12 sh.(Sci)
Approved Electives[3,6]	6 sh.(Tech)	9 or 10 sh.
Sr. Research/ Project[5]		3 or 2 sh.
	66	66

Engineering Fields of Concentration available under the B.S.-Engineering program as primary fields within either the Engineering option or the Applied Science option as follows:

Aerospace Engineering	Electrical Engineering
Agricultural Engineering	Engineering Materials
Chemical Engineering	Mechanical Engineering
Civil Engineering	Nuclear Engineering
Fire Protection	

All engineering fields of concentration may be used as a secondary field within the engineering option.

Educational activities within the field of Fire Technology and Fire Engineering

FIRE PROTECTION CURRICULUM

		Semester I	Semester II
	Freshman Year		
	General University Requirements	6	3
CHEM 103, 104	General Chemistry	4	4
PHYS 161	General Physics I		3
MATH 140, 141	Analysis I, II	4	4
ENES 101	Introduction to Engineering Science	3	
ENES 110	Statics		3
	TOTALS	17	17
	Sophomore Year		
	General University Requirements	3	3
MATH 240	Linear Algebra or	4	
MATH 241	Analysis III		
MATH 246	Differential Equations		3
PHYS 262, 263	General Physics	4	4
ENES 221	Dynamics	3	
ENES 220	Mechanics of Materials		3
ENFP 251	Introduction to Fire Protection Engineering	3	
ENFP 280	Urban Fire Problem Analysis		3
	TOTALS	17	16
	Junior Year		
	General University Requirements	3	3
CMSC 110	Elementary Algorithmic Analysis or	3	
ENES 240	Algorithmic Analysis and Computer Programming		
ENME 320	Thermodynamics or		3
ENCH 295	Chemical Process Thermodynamics		
ENCE 300	Fundamentals of Engineering Materials or		3
ENME 300	Materials Science and Engineering		
ENCE 330	Fluid Mechanics	3	
ENFP 312	Fire Protection Fluids	3	
ENFP 310	Fire Protection Systems Design I		3
ENFP 320	Pyrometrics of Materials	3	
ENFP 321	Functional and Structural Evaluation		3
	Approved Electives	2	2
	TOTALS	17	17
	Senior Year		
	General University Requirements	3	6
ENNU 310	Environmental Aspects of Nuclear Energy or	3	
ENEE 300	Principles of Electrical Engineering		
ENFP 414	Life Safety System Analysis		3
ENFP 411	Fire Protection Hazard Analysis	3	
ENFP 415	Fire Protection System Design II	3	
ENFP 416	Problem Synthesis and Design		3
	Technical Electives	3	3
	TOTALS	15	15

Total Credit Hours = 131
(3 credits of technical electives must be in ENFP)

COURSE ENFP 251: INTRODUCTION TO FIRE PROTECTION ENGINEERING (3 CREDITS)

Prerequisites, MATH 141, and CHEM 104. Analysis of the social, economic environmental, organizational and legal dimensions of the fire problem. Examination of the theoretical principles relating to basic fire phenomena and theories of extinguishment. Introduction to fire research.

COURSE ENFP 280: URBAN FIRE PROBLEM ANALYSIS (3 CREDITS)

Prerequisite ENFP 251. Intensive study of the urban fire problem. Operations research techniques and systems engineering are utilized as analytical procedures for the technological assessment of public fire protection. Traditional assessment methods and urban analysis.

COURSE ENFP 310: FIRE PROTECTION SYSTEMS DESIGN I (3 CREDITS)

Prerequisite ENFP 312. Study of aqueous suppression system agents and their application to selected fire protection problems. Examination of specifications, code criteria, published criteria and research utilized in the engineering design of aqueous agent suppression systems. Application of hydraulic theory to a range of design considerations. Problem calculations based upon student prepared design layouts.

COURSE ENFP 312: FIRE PROTECTION FLUIDS (3 CREDITS)

Corequisite ENCE 330. Study of fluid flow principles for fire protection systems. Analysis of hydrostatic and hydrodynamic problems associated with municipal and industrial water supply distribution systems. Calculation methods, techniques, and procedures for hydraulically designed distribution networks to meet prescribed conditions of adequacy and reliability of the total system.

COURSE ENFP 320: PYROMETRICS OF MATERIALS (3 CREDITS)

Analysis and study of characteristics of materials, and material assemblies related to flame spread, fuel contribution, combustibility and smoke development. Analysis of fuel geometry and configuration to fire severity. Procedures of laboratory analysis, determination and modeling.

COURSE ENFP 321: FUNCTIONAL AND STRUCTURAL ANALYSIS (3 CREDITS)

Prerequisite ENFP 320. Examination of the functional and structural components of buildings and building complexes relative to modular fire loss potential. Analytical concepts and research developments related to modular loss evaluation. Investigation of the performance criteria of building and fire prevention codes.

COURSE ENFP 411: FIRE PROTECTION HAZARD ANALYSIS (3 CREDITS)

Prerequisites ENFP 251, 310. Corequisite ENFP 415. Examination of diffusion flame phenomena and material flame propagation and development in industrial and related environments. Synthesis of design procedures relative to the total application of fire protection engineering with economic and cost benefit analysis.

COURSE ENFP 414: LIFE SAFETY SYSTEMS ANALYSIS (3 CREDITS)

Prerequisite ENFP 321. Detailed examination and study of the physical and psychological variables related to the occurrence of fire casualties. The investigation of functional features of smoke movement and egress. Review of systematic procedures for analysis of life safety in structures, and the incorporation of such procedures into the design process.

COURSE ENFP 415: FIRE PROTECTION SYSTEM DESIGN II (3 CREDITS)

Prerequisite ENFP 310, 312. Study of gaseous and particulate fire suppression systems plus hazard detection systems. Examination and evaluation of code criteria, performance specifications and research relation to the study areas. Application of fluid theory to the design layout and the calculation procedures for gaseous and particulate fire suppression systems. Functional analysis and design layout of detection systems. An integrated fire protection systems design project.

COURSE ENFP 416: PROBLEM SYNTHESIS AND DESIGN (3 CREDITS)

Prerequisite: senior standing. Techniques and procedures of problem orientation and solution design utilizing logical and numerical procedures. Student development of research projects in selected areas.

COURSE ENFP 489: SPECIAL TOPICS (3 CREDITS)

Prerequisite: permission of the department. Selected topics of current importance of fire protection. Limited to a total of six credits.

STUDENT RESEARCH PAPERS

From 1962 till now 181 student research papers have been carried out. A complete list of the papers is available. During the last two years the following student research papers have been carried out:

A Comparison Between One Quarter Scale and Full Scale Post Flashover Combustion Phenomena (P.J. DiNenno, 1977).

A Study of the Effects That a Uniform Electric Field Has on Flame Treated as a Plasma (R.H. Lee, 1977).

An Investigation into the Effects of Plastics and Wood Fuels on Fire Build Up Using the Quarter Scale Compartments (J.M. Thompson, 1977).

A Comparison of Fire Endurance of Wall Assemblies Utilizing Computer Simulation (J.A. Alderman & S. Dannaway, 1978).

The Effect of Low Ventilation Rates on Fires (R.C. Beller, 1978).

The Effects of Severe Winter Weather on Municipal Fire Protection (P. Felton, 1978).

Lithium Batteries: A Fire Hazard? (C.L. Gandy, Jr., 1978).

A Study on the Flammability and Rate of Burn Characteristics of a Nylon Fiberglass-Reinforced Thermoplastic Chair (P.J. Hoge, 1978).

A Study of the Corrosive Effects of Polyvinyl Chloride Cable Insulation on Electrical Equipment (W.W. Jung, 1978).

A Study to Determine the Optimal Location, Reliability, and Personal Preference and Attitude Toward Residential Smoke Detectors (R. Levine, 1978)

Small and Large Scale Flame Spread Evaluation: An Attempt to Correlate Radiant Panel Test Results with Full Scale Corner Test Data (J.L. Scheffey, 1978).

Metrication and Fire Protection (D.A. Stobaugh, 1978).

Development of a Standard for Fire Protection Design of Electric Generating Stations (L. Warnick, 1978).

The Design, Development and Specifications of a Plastic, Dry-Pipe Sprinkler Valve (D. Snyder, 1978).

A Study of The Trends in The Colors of Emergency Warning Lights and of Fire Apparatus in The State of Virginia (K.E. Bacon, 1978).

The Design and Study of Floor Mounted Directional Exit Lighting System (B.W. Melly, 1978).

Continuing Education For The Fire Protection Engineer: A Survey and Proposal (D.A. Moore & R.L. Vezzani, Jr., 1978).

An Examination and Analysis of Inherent Hazards of Present Fire Fighter's Protective Garments (F.K. Walker, 1978).

A Comparative Analysis of The Fire Loss Sustained with Respect to The Utilization of Smoke Detectors in Prince Georges County, Maryland (B.L. Briese & L.J. McGinty, 1979).

An Analysis of The Extingiushing Capability of Equivlently Rated Class A Fire Extinguishers (J.R. Cochrane, 1979).

Loss Rate Analysis of Partial versus Full Sprinkler Systems in Single Family Residences (L.E. Fisher, 1979).

A Study to Determine The Necessity of Requiring Smoke Detectors by Law in Homes (S.M. Hudson, 1979).

Construction of an ASTM-286 8 ft. Flame Spread Tunnel and Proposed Laboratory Procedures to be Followed in the Pyrometrics Laboratory (D. Rehmeyer & R. Hild, 1979).

An Analysis of The Attenuation of The Audible Signal Produced by Single Station Smoke Detectors (E. Stauffer, 1979).

Testing and Analysis of Smoke Control Systems - A Case Study (E.B. Douberly, 1979).

An Investigation of Fire Growth Phenomena - Theoretical and Experimental (D.M. Walencewicz, 1979).

A Study of Ionization Chamber and Photoelectric Smoke Detector Reliability and Tradeoffs from Reliability (R.D. Wilson, 1979).

Fire research activities with relation to Fire Engineering Education

A Study of the Relationship of the National Fire Academy to the Fire-Related Education Programs in Colleges and Universities (J.L. Bryan, 1977).

Smoke as a Determinant of Human Behavior in Fire Situations (Project People I) (J.L. Bryan, 1977).

Proceedings of a Conference and Workshop on Tactical Command, Control and Communications (H.E. Hickey & B.M. Halpin, 1978).

Simulation and Gaming Programs for the National Fire Academy (H.E. Hickey, 1978).

A Theoretical Rationalization of a Goal-Oriented Systems Approach to Building Fire Safety (J.M. Watts, Jr., 1978).

Human Behavior in a Fire a Bibliography (J.L. Bryan, 1978).

A Study Comparing the Perceived Involvement of Fire Department Officers in Operational and Management Function: 1968 and 1978 (H.E. Hickey, 1979).

Special publications concerning the fire-educational activities at the institution

Booklet: Fire Protection Engineering (University of Maryland)

Supplementary remarks

ENROLLMENT DATA, FIRE PROTECTION CURRICULUM
COLLEGE OF ENGINEERING, UNIVERSITY OF MARYLAND SEPT., 1956 - DEC., 1979
ENGINEERING PROGRAM

Year	Enrollment Fall Semester	Entering Students	Graduates
1956	7		
1957	10		
1958	24		
*1959	26		
1960	43		
1961	63		
1962	64		4
1963	72		5
1964	82	32	14
1965	89	39	14
1966	82	29	9
*1967	74	22	16
1968	53	14	13
1969	45	16	11
1970	45	11	7
1971	36	16	7
1972	44	23	14
1973	48	20	6
1974	63	33	6
1975	66	33	8
1976	91	39	14
1977	97	35	12
1978	105	36	16
1979	124	44	20
		TOTAL	196

*Duration dates for the insurance student support program

Only Engineers Council for Professional Development accredited in Fire Protection Engineering in the United States (cf Engineering Education and Accreditation Report 1977, Annual Report Volume 2).

In 1977 approval was given for a change in name of The Fire Protection Curriculum to The Department of Fire Protection Engineering.

UNIVERSITY OF CALIFORNIA, SAN DIEGO USA

Name and address of the institution

Department of Applied Mechanics and Engineering Sciences
University of California, San Diego
La Jolla, California 92093
USA

Members of the staff involved in fire-educational activities

F. A. Williams Ph. D.

Summary of the general education system with special reference to activities within the field of Fire Technology and Fire Engineering

The University of California at San Diego is one of the smaller campuses of the University of California. Bachelor's, Masters and Ph. D. degrees are offered in humanities, sciences and engineering. The engineering program is oriented toward applied science and is basic in character. There are no programs directed specifically to fire technology or fire engineering.

Educational activities within the field of Fire Technology and Fire Engineering

One undergraduate course was offered for the first time in the Spring of 1978 on Urban and Wildland Fire Phenomenology. It emphasizes basic aspects of fire as a phenomenon and touched only peripherally on its economic impact and social implications. Attention is given to the physics, chemical equilibria, chemical kinetics, fluid dynamics, transport properties and heat and mass transfer that occur in fires. Prediction of fire histories and the development of methods for fire control are reviewed. The course meets 3 hours each week for a 10 week period.

Fire research activities with relation to Fire Engineering Education

There is a graduate research program on flame extinction in relationship to fire suppression. Students seeking Masters and Ph. D. degrees may participate in fire research under this program.

UNIVERSITY OF CALIFORNIA, BERKELEY USA

Name and address of the institution

Structural Engineering and Structural Mechanics
University of California, Berkeley
507 Davis Hall, Berkeley
California 94720
USA

Members of the staff involved in fire-educational activities

Professor R. B. Williamson

Educational activities within the field of Fire Technology and Fire Engineering

COURSE CE 198-2: BUILDING CODES AND FIRE PROTECTION ENGINEERING (3 UNITS)

Model building codes are introduced with emphasis on fire safety provisions. Relationship between these codes and fire insurance coverage, federal standards and fire protection engineering are presented. This is an introduction to fire protection engineering which will give the students the framework for solving fire problems that fall outside the building code. The language and structure of model building codes are introduced and one model building code is reviewed in detail. Those portions of the code which relate to fire safety are emphasized and the relationship between building codes, fire insurance coverage, federal standards and other controls to achieve a given level of fire safety are presented and examined from a scientific viewpoint.

This course is intended as an upper division course that can be taken as an elective by students enrolled in any of the engineering departments or the department of architecture. It may be of interest to students in government, business, law and other specialities provided they have appropriate background in physical science, architecture or engineering.

Prerequisites: E45 and CE130 (architecture students should have passed CE128A with a grade of "A" or "B").

Required textbook: Uniform building code.

Course Objectives

1. The student will be able to determine whether a given building design meets the fire requirements of a model building code.
2. The student will be introduced to the basics of fire safety in buildings and will be able to justify variances to the code.
3. The student will be introduced to the fundamental principles of fire protection design which can be used as a foundation for more detailed study.

UNIVERSITY OF WASHINGTON — USA

Name and address of the institution

College of Engineering,
University of Washington,
Seattle,
Washington 98195,
USA

Members of the staff involved in fire-educational activities

Professor R. C. Corlett,
Professor K. L. Garlid
in collaboration with colleagues at the university and local professional fire protection engineers.

Summary of the general education system with special reference to activities within the field of Fire Technology and Fire Engineering

The University of Washington is a typical major American state university. The programs offered are too diverse for summary. Vocational programs are handled in other components of the state higher education system. There are numerous professional programs in the University, but highly specialized programs such as Fire Technology and Fire Engineering are not offered. The College og Engineering offers B.S., M.S., and Ph.D. programs in all of the traditional areas of engineering (e.g. Mechanical, Electrical, Civil). To a limited extent, students can create specialities by appropriate selection of electives. The College of Architecture also offers degrees in Building Construction as well as Architecture in general.

Educational activities within the field of Fire Technology and Fire Engineering

The only formal activity within the field of Fire Technology and Fire Engineering is a one credit hour briefing type course taught by local professional fire protection engineers. The possibility of expansion to a full blown (three or four credit hour) technical elective is being explored, with the extent of evolved student demand the primary factor. Within the College of Forest Resources is a Fire Science and Technology Program aimed exclusively at open fires (controlled and unwanted) in wild land fuel beds. The technology differs radically from that of Fire Technology and Fire Engineering in buildings and the program is not covered further in this questionaire. Program description may be obtained from Professor S. Pickford, College of Forest Resources, University of Washington.

Fire research activities with relation to Fire Engineering Education

Usually one or two externally funded fire research grants or contracts are active in the Department of Mechanical Engineering. One or two graduate students, mostly M.S. candidates, complete theses each year. Research themes are applied but not necessarily oriented toward immediate practice. For example, one of the current projects involves mixing phenomena in fire suppression by nitrogen pressurization, which has been proposed for submersed vessels; no system using this technique have yet been installed on operation vessels.