The Development of Training Courses in Industrial Ventilation

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In order to extend and fully utilise the vast amount of information included in the Industrial Ventilation Design Guide Guides, international discussions have taken place regarding the development of training courses covering all aspects of the guides. The proposed courses must be carefully graded into degrees of difficulty, making them suitable for students, academics, practicing consulting engineers, maintenance engineers, plant design engineers as well as management. In order to meet this aim, the topics have to be constructed to provide a sufficiently broad application, flexible and be capable of fine-tuning.

A definite requirement exists for supporting undergraduate educators, technical colleges, and in house training for manufacturers, consultants and managers in the associated fields of Industrial Ventilation. The aim being to develop both theory and applications orientated problem workbooks, which are capable of supporting all courses.

It will be appreciated that this task is by no means an easy one, due to the professional qualifications and working practices of engineers varying from country to country.In Europe careful consideration must be given to ensuring that engineers involved in the industrial ventilation field are kept up to date with the development in CEN Standards and International Standards.

The process of change is a continuing one, and the professional training of engineers must be kept under constant review, to ensure that they are not left behind in developments in this field. Not only does the industrial ventilating industry employ a wide range of specialists, but also the nature of employment in the industry covers the full range of engineering activities such as design, manufacture, installation, maintenance and operation of plant and systems. As the subject of industrial ventilation embraces so many different types of activity and diverse technologies, it will be appreciated that in each area there must be a specialist in set areas for large and complicated projects.

Before introducing industrial ventilation into the curricula of formal education, the nature of the industry must be considered. As it is involved with the internal environment, it is related to the construction industry and concerned with the engineering and performance of systems.

Problems in educational development of similar courses in Building Services. Engineering have experienced difficulties in covering widely different technologies in the spectrum of mechanical engineering, electrical engineering, chemical engineering, health and safety, building services engineering, the built environment, building construction, management and organisation, systems engineering and control, electrical

power, thermodynamics, applied heat and mass transfer, fluid mechanics, fuels and combustion, corrosion, energy economics, health studies.

Degrees, typically in mechanical and electrical engineering do not cover adequately the background required by an industrial ventilation engineer as they are lacking in the necessary topics and practical training and professional experience. A clear distinction must be drawn between technician's courses and technologist courses. The course proposals are suitable for an M.Eng degree, however; simply by removing some of the academic rigor and depth, the proposed subject are suitable for all grades of studies

Technician courses are deliberately restricted in breadth and are aimed at the development of design skills, and examinations in these are intended to test abilities to use design techniques, though basic understanding is also required. Technician engineers are required to have a deeper understanding of design methods and their education extends into management, but emphasis is still placed on design, but the breadth is restricted. The technologist is required to have broader knowledge and a greater understanding of engineering principles and be capable of innovative design.

The coverage being the basic principles, fluids, chemistry, heat and mass transfer, thermofluids, atmospheric effects, health risk assessment, pollution effects, air cleaning, water cleaning, control processes, particulate control, air dispersion modelling, health and risk assessment, risk communications, standards, economics, materials, ethics, case studies etc.

Typical Syllabi could be:

M.Eng. Year 1.

Subject.	Time Hours
Human Physiology.	10
Building Construction, Theory of Structures & Building Fabric.	30
Theory of Materials.	10
Human Communication Theory and Practice.	10
Mathematics.	20
Engineering Applications.	10
Elements of Chemistry.	10
Thermo Fluids Heat and Mass Transfer.	20

M.Eng. Year 2.

Subject.	Time Hours
Building Construction.	5
Engineering Plant.	5
Building Environmental Performance.	10
Thermofluids, Combustion Heat and Mass Transfer.	20
Engineering Drawing including CAD.	10
Electrical Theory.	15
Mathematics and Statistics.	15
Engineering Processes	10
Energy Resources.	10
Pollution Control.	10

M.Eng. Year 3.

Subject.	Time Hours
Research Project I.	15
Design of Pollution Control Systems.	15
Design of Electrical Services.	15
Design of Engineering Control Systems.	15
Theory and Practice of Acoustic and Vibration Control.	20
Advanced Design Project.	15
Meteorological Effects.	15
International Standards and Statutory Regulations.	10

M.Eng. Year 4.

Subject.	Time Hours
Chemical Processes.	20
Pollution Control.	20
Owning and Operating Costs.	10
Project Management.	10
Environmental Issues.	20
Advanced Mathematics.	10
Research Project.	20
Energy and Energy Economics.	10

Year I

Human Physiology

Aims To cover the basic elements of human physiology relating to thermal, acoustic, vibration, light, atmospheric pollution and ionising radiation.

Outcomes To provide the students with an understanding of what various physical and chemical effects have on the health of people.

Building Construction, Theory of Structures & Building Fabric

Aims To develop an understanding of the principles of construction technology. The traditional and modern methods of construction, and the selection of appropriate methods for given situations. To consider the elements of structural design.

Outcomes To ensure that the basic principles, terminology and design methods of building design and structural behaviour are understood.

Theory of Materials

Aims To consider the nature of the materials used in all aspects of engineering.

Outcomes To make the students aware of the use and limitations of the materials in use.

Human Communication Theory and Practice

Aims An introduction to the methods available necessary to communicate effectively making use of the latest developments in information technology.

Outcomes To develop skills in searching, collecting, analysis and the presentation of information.

Mathematics

Aims To extend the mathematical skills of the student relating to engineering and environmental problems.

Outcomes To provide a basic working knowledge in the use of elementary functions, differentiation and integration

Engineering Applications

Aims To introduce the student to the aims of the following years of the course with an emphasis on the relationship of industrial ventilation to health and the other subjects covered.

Outcomes Ensure that the students fully appreciate the interrelationship of all the subjects involved.

Elements of Chemistry

Aims To provide the student with a working knowledge of the elements of chemistry.

Outcomes To allow the student to deal with combustion and other reaction problems.

Thermo Fluids Heat and Mass Transfer

Aims To cover the theoretical background relating to thermal, fluid, heat and mass transfer engineering. And relate these to the practical processes involved in future work.

Outcomes To ensure that the foundations for all future topics covered are understood and related to practical applications

Year 2

Building Construction.

Aims To expand on the theory covered in the first year, and relate this to the positioning of mechanical and electrical services within the structure.

Outcomes To ensure that the student has a full appreciation of the building shell and it's associated incoming and outgoing services.

Engineering Plant Construction

Aims To introduce the student to the construction and operation of all the items of plant that will be encountered in future studies.

Outcomes To relate the practical appreciation of mechanical and electrical plant.

Building Environment Plant Performance

Aims To relate plant operation to the control of the environment.

Outcomes To appreciate the interrelationship of the plant selected with the equipment.

Thermofluids, Combustion Heat and Mass Transfer

Aims To extent the work covered in the first year specialising more on the problems encountered in pollution control.

Outcomes To provide a coherent interrelationship of all aspects of this subject.

Engineering Drawing

Aims To introduce the student to Current Drawing Office Practice including CAD.

Outcomes To provide the student of a practical background in this important field.

Electrical Theory

Aims To introduce the student to basic electrical theory applicable to industrial ventilation.

Outcomes To ensure a working knowledge of the theory that can be applied in all future work.

Mathematics and Statistics

Aims To extend the students knowledge into the field of applied mathematics.

Outcomes To allow the student to deal with complex heat and mass transfer problems.

Engineering Processes

Aims To consider the various industrial process that give rise to atmospheric pollution.

Outcomes Will allow the student to appreciate the various forms of pollution generated.

Energy Resources

Aims To introduce the student to fossil fuel and renewable sources of energy.

Outcomes To allow the student to appreciate the advantages and disadvantages of fuel types and to understand the economics of reserves.

Pollution Control

Aims To introduce the student the various methods by which pollution can be controlled in and out of buildings.

Outcomes To combine pollution control theory with practice.

Year 3

Research Project I

Aims To allow the students to work both individually and as a group of a research project of their own choice.

Outcomes To introduce the student to teamwork, and work application.

Design of Pollution Control Systems

Aims To consider the problems of pollution control system design.

Outcomes To extend the work covered in thermofluids and in heat and mass transfer.

Design of Electrical Services

Aims To extend the theory covered in second year to the design of electrical services.

Outcomes To allow the student to fully appreciate the main issues in the design and distribution of electrical services in and out of buildings.

Design of Engineering Control Systems

Aims To introduce the student to electrical, mechanical and pneumatic control and to the methods of measurement.

Outcomes To provide a working knowledge of the selection and limitation of different control systems.

Theory and Practice of Acoustic and Vibration Control

Aims To introduce the student to the essential aspects of sound and vibration control.

Outcomes To provide a working knowledge of what influence these have on humans and buildings.

Advanced Design Project

Aims To extend the work covered in the second year.

Outcomes To work as a team and to utilise previous years work.

Meteorological Effects

Aims To consider the influence the weather has on pollution dispersion and on environmental control.

Outcomes To relate the influence of the weather with efficient plant operation.

International Standards and Statutory Regulations

Aims To introduce the students to the complex and rapidly changing world of standards.

Outcomes Providing an appreciation of the international standards relating to all the relevant subjects involved.

Year 4

Chemical Processes

Aims To consider the various chemical industries which produce liquid, gaseous and particulate emissions.

Outcomes To provide the students with an understanding of processes and the nature of emissions.

Pollution Control

Aims To consider all the issues related to pollution control.

Outcomes To select plant suitable for the economic cleaning of all sources of pollution.

Owning and Operating Costs

Aims To provide a comprehensive understanding of the factors involved in owning and operating complex items of engineering plant

Outcomes Ensure that a complete working knowledge of the issues of LCC can be applied to the selection of plant and its efficient running.

Project Management

Aims To instil by means of case studies and the underlying theory a positive attitude to project management.

Outcomes Ensuring a comprehensive understanding of the complex task of managing an engineering project.

Environmental Issues

Aims To ensure that all the environmental issues covered to date are compacted into a coherent form.

Outcomes To widen the understanding of the many complex issues that is involved in this field.

Advanced Mathematics

Aims To ensure that the students receive an adequate introduction to the mathematics that will be used in the final year topics

Outcomes To applying the all the mathematical theory to the other topics covered.

Research Project II

Aims To provide the students with an understanding of the process of research

Outcomes The research paper written will be presented by the student and reviewed and refereed by other students on the course.

Energy and Energy Economics

Aims To extend the students knowledge of different energy forms and the underlying economic theory.

Outcomes To widen the understanding of the utilisation of fossil fuels and renewable resources that can be used for all applications. And the analysis and prediction of its use within the process.

Conclusions

From the above it will be seen that the breadth of topics result in a complex series of interconnected subjects that are related to industrial ventilation. The author has a series of individual syllabi and open learning texts on some of the topics, which are suitable for courses at university, technical colleges and in-house training.