

Scandinavian Academy
Training Center

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Riyadh - Al Khaleej District - Sheikh Abdul Aziz Bin Abdul Rahman Bin Bishr Street - 13223 - Office No. 5 | P.O.BOX : 13224

Course: Heat Transfer: Augmentation Techniques in the Process Industry

Code	City	hotel	Start	End	price	Language - Hours
CM-136SA	Al Baha	Hotel Meeting	2027-05-30	2027-06-03	13950 SR	En - 25

The Course

Progress in the development of high performance thermal systems has stimulated interest in methods to improve heat transfer, popularly called “heat transfer augmentation”. It has become second generation heat transfer technology. New techniques are primarily employed in a variety of thermal apparatuses encountered in process and chemical industries, including oil refineries and gas production plants as well as in power generation plants (thermal, nuclear, solar, geothermal, ocean thermal, etc.).

This course describes the most important and practical issues related to the optimum selection of various types of augmentation techniques employed for heat exchangers working with single-phase fluids (heaters or coolers) or with phase change fluids (evaporators, reboilers, condensers, etc.) The course will briefly survey basics of fluid flow and heat transfer in thermal apparatuses and continue with a detailed explanation of the most efficient passive (extended surfaces, fins, swirl flow devices, etc.) and active techniques (surface and fluid vibration etc.) for single phase flow as well as for fluids with phase-change (two-phase flows). Performance evaluation criteria (PEC) related to these techniques, as well as technical and economical issues, such as manufacturing costs, problems in operation, maintenance issues and others will be covered.

Highlights of the course include:

- Basics of selecting the most appropriate heat augmentation technique for the given application: augmentation techniques improve heat transfer for the price of increased pumping power

- Guidance for performance evaluation criteria which are basis for selection
- Practical real-life examples where finned tubes and tube inserts require careful operation and maintenance
- Interplay of various influencing design parameters: two or more techniques can work together as compound augmentation
- Economical issues: cost and benefit analysis

The Goals

This course will enable the participants to achieve the following:

- Understanding of heat transfer processes and fluid flow in thermal equipment in order to apply suitable heat augmentation techniques
- Familiarity with principles of thermal design of heat exchangers
- Selection of optimal heat transfer augmentation techniques for a given industrial application
- Skill in estimating the degree of deterioration and inefficiency of heat exchangers and the ways to improve it by heat augmentation method
- Knowledge on how to analyze problems in everyday operation and how to combine heat exchanger alteration technique with heat transfer augmentation

The Process

This course will be conducted with discussions and strong focus on teamwork within workshops and during lectures. Comprehensive workshops are included using real life cases as examples, where participants will learn calculation procedures and their results. Open fora will be held to emphasize key learnings and to inspire delegates to exchange view points based on professional experiences.

The Benefits

This course will benefit the delegates through:

- Improved knowledge and experience with various types of heat transfer augmentation techniques available in today’s industrial practice
- Better understanding of methods to employ particular technique for the given heat exchanger or any other thermal apparatus
- Comprehensive vision about the performance evaluation criteria for the applied augmentation procedure
- Recognizing and understanding the limitations of heat augmentation techniques
- Familiarity with new augmentation techniques in the heat exchanger industry regarding the demand for better thermal efficiency

The Results

The course will benefit the company through:

- Heat exchangers with improved efficiency will prolong the life of the plant and significantly reduce overall costs of technological process
- Efficient operation of improved heat exchangers will result in the overall improvement of technological process and substantial financial savings
- Efficiently modified heat exchangers by skilled personnel will result in energy saving and in the reduction of costs of the overall technological process
- Financial performance of the company will be improved by an adequate selection of the most appropriate augmentation technique that will lead to best thermal efficiency of thermal device
- Engineers in the maintenance department will be able to follow the best practices repair, alteration and modification.

The Programme Content

Day One

Overview of Heat Transfer Equipment in the Process Industry

- Thermal Efficiency of Heat Transfer equipment
- Performance Indicators
- Analysis of Costs: Operating and Maintenance costs
- Need for Heat Transfer Augmentation
- Classification of Augmentation Techniques
- Performance Evaluation Criteria (PEC)

Day Two

Basics of Heat Transfer and Fluid Flow Mechanisms in Thermal Equipment

- Conduction Heat Transfer - Concept of Thermal Resistance
- Basics of Fluid Flow in various Geometries
- Pressure drop calculation and selection of Pumps and Compressors
- Convection Heat Transfer
- Heat transfer with phase change : Boiling and Condensation
- Solutions to various Heat Transfer problems

Day Three

Augmentation Techniques for Single Phase Fluid Flow

- Most Efficient Passive Techniques
- Extended Surfaces and Fins
- Swirl Flow Devices and Fluid Additives
- Most Efficient Active Techniques
- Stirring devices and Rotating surfaces
- Surface and Fluid Vibration
- Applications of Finned Surfaces in Forced Convection

Day Four

Augmentation Techniques for Fluids with Phase Change

- Most Efficient Passive Techniques
- Treated and Rough Surfaces
- Extended Surfaces and Displaced Enhanced Devices
- Swirl Flow Devices and Fluid Additives
- Most Efficient Active Techniques
- Surface and Fluid Vibration
- Electro-magnetic Field
- Solutions to problems of Boiling and Condensation

Day Five

Technical and Economical Issues

- Application of Compound Augmentation
- Cost-benefit Analysis: Manufacturing Costs vs. Benefits of Augmentation Techniques
- Problems in Operation
- Maintenance Issues
- Future Trends

The Scandinavian Academy for Training Center adopts the latest scientific and professional methodologies in training and human resource development, aiming to enhance the efficiency of individuals and organizations. Training programs are delivered through a comprehensive approach that includes:

- Theoretical lectures supported by PowerPoint presentations and visual materials (videos and short films).
- Scientific evaluation of participants before and after the program to measure progress and knowledge acquisition.
- Brainstorming sessions and practical role-playing to simulate real-life scenarios.
- Case studies tailored to align with the training content and participants work nature.
- Assessment tests conducted at the end of the program to evaluate the achievement of training objectives.

Each participant receives the training material (both theoretical and practical) in printed form and saved on a CD or flash drive. Detailed reports, including attendance records, final results, and overall program evaluations, are also provided.

Training materials are prepared professionally by a team of experts and specialists in various fields. At the end of the program, participants are awarded a professional attendance certificate, signed and accredited by the Scandinavian Academy for Training Center.

Program Timings: 9:00 AM to 2:00 PM

The program includes:

- A daily buffet provided during the sessions to ensure participants comfort.
- A closing ceremony on the final day to distribute certificates and celebrate participants achievements.
- **Note: All prices are exclusive of 15% Value Added Tax (VAT).**

Our Success Partners

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