Energy Recovery and Reuse (ERR)

Pinch analysis technique for synthesizing and retrofitting heat exchanger networks has been found effective in many industrial applications for improving energy recovery and reuse. Engineers, particularly those dealing with heat transfer processes and heat transfer equipment such as furnaces, heat exchangers and coolers, should know pinch analysis concepts and its applications for improving energy efficiency. Major topics that will be discussed in this module include pinch analysis concepts, heat balances and data extraction, finding heat recovery targets, heat exchanger network design, selection of utilities, heat and power systems and evaluating achievable energy savings versus investment; Other energy recovery techniques including the use of absorption chillers, expanders, heat engines, heat pumps, etc as well as techniques and equipment for retrofitting existing heat exchanger networks. Industrial applications will be outlined, and the potential of energy recovery and reuse for improving energy efficiency in these applications will be discussed.

Steam and Compressed Air Systems (SCAS)

Steam and compressed air systems consume significant energy in industrial plants. In addition, there are many opportunities to recover waste heat from various industrial processes. Therefore, energy efficient design and appropriate operation strategies for these systems have the potential to significantly reduce energy consumption in industrial facilities. Major topics discussed include the function of the various components in steam and compressed air systems, heat and mass transfer analysis, evaluation of system performance, potential for heat recovery, influence of different variables on energy optimization, energy efficient design, operation and control strategies, sustainable practices, selection and arrangement of heat recovery devices, operations and maintenance.

Combined Heat and Power (CHP) Systems

The use of sustainable CHP systems versus conventional electrical power plants and fuel fired boilers can reduce the energy loss resulting in reduced emission and environmental impact. These combined power plants can also be made to function as cogeneration or trigeneration systems producing two or three useful effects simultaneously. Major topics discussed in this module include thermal concepts of CHP, the Brayton Cycle, vapour power cycles, power equipment and systems such as gas turbines, microturbines, fuel cells, steam turbines, etc; cogeneration systems; feasibility studies and regulatory issues related to on-site generation. Candidates taking the CHP Systems paper are to be familiar with:

1. Energy Market Authority – Policy on Direct Supply of Electricity by Generating Sets to On-site Loads (2002) and subsequent revisions in 2006 and 2008.

Building Envelope and Lighting Systems (BELS)

The façade together with the rest of the building envelope and roof contribute most to the solar heat gain of a building. Energy managers should be well-equipped with knowledge and technical skills to minimise these loads. Possession of a good knowledge of lighting products, systems, design & methods of integrating supplementary daylight will help energy managers to save on lighting and thermal loads. Major topics discussed in this module include façade systems (monocoque & hybrid), curtain and glass wall systems, energy and sustainability with different types of envelopes-shades & louvres; daylighting design principles, concepts, tools and standards; calculation of ETTV and RETV wall, roof and fenestration of a building; lighting principles, eco-friendly lighting design, characteristics of lamps, LED, ballasts, lighting design method, control-upgrades for energy-efficiency and life-cycle comparison. Candidates taking the BELS paper are to be familiar with:

1. Code on Envelope Thermal Performance for Buildings (www.bca.gov.sg/performancebased/others/retv.pdf)
2. Guidelines on Envelope Thermal Transfer Value for Buildings
3. SS531-1 : Code of practice for lighting of work places – indoor lighting of workplaces
4. SS530 : Energy Efficiency Standard for Building Services and Equipment
5. Structural use of glass in building (The Institute of Structural Engineers, December 1999)

Note to Candidates

Candidates are to refer to the latest versions of the Standards, Codes of Practice listed in the short descriptions above.