



Mechanical Power Engineering MPEN-SA-06

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MPEN-SA-06-02	VALVES: SELECTION, INSTALLATION AND MAINTENANCE
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MPEN-SA-06-04	HEAT EXCHANGERS DESIGN
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MPEN-SA-06-18	MATERIAL TESTING AND QUALITY CONTROL TOOLS
MPEN-SA-06-19	OPERATION AND MAINTENANCE OF GAS AND STEAM TURBINES



Acquainting engineers working in the field of machinery maintenance to the different aspects of vibration measurement and analysis. This is strongly required to apply advanced programs for machinery predictive maintenance and balancing of rotors using vibration measurement.

Course Outline

- Tests for resonance synchronous time averaging, sand patterns, spectrum analysis, orbit analysis , time waveform analysis, modal analysis, finite element analysis cestrum analysis , envelop analysis, kurtosis, shock pulse technique, crack detection
- Vibration signals: types and recording
- Human sensors
- Vibration instruments
- Measurement techniques
- Techniques for machinery vibration analysis: amplitude mapping phase relationships Bode, polar and waterfall plots
- Case study

Valves are used frequently in many industrial applications. Their use in process industries, power plants and utilities is quite frequent. This course covers the different factors involved in selecting, installing, using and maintaining of valves in industry.

Course Outline

- Review of different types of valves and factors influencing their selection
- Hydraulic considerations, Valve materials
- Installation techniques and good practices
- Maintenance and surveillance of valves to avoid long downtimes and to ensure safe system operation
- Control valves, their choice and sizing for the appropriate service
- Check valves, their selection, design and installation
- Selection and design of valve actuators
- Case studies



COEN-SA-06-03

DESIGN AND SELECTION OF FLUID POWER PUMPS AND MOTORS

This course gives the practicing engineer an insight into the applications of fluid power actuation and control. The survey on the large number of design variants of pumps and motors is associated with typical design calculations involving forces, torques, and flow ripple analysis.

Course Outline

- Comparative evaluation of pump motor designs
- Low-speed high-torque (LSHT) motors and their performance characteristics
- Case studies
- Application areas of fluid power actuation and controls
- Classification of fluid power pumps and motors
- Design variants according to the kinematics principle
- Performance efficiency characteristics of pumps and motors
- Analysis of forces and torques: fluctuations
- Analysis of flow ripple, bearing problems in pumps/motors

COEN-SA-06-04

HEAT EXCHANGERS DESIGN

This course is intended to introduce the engineers to the basic concepts and procedures applied in heat exchanger design. Different methods of enhancing heat transfer and optimization of heat exchanger performance will be discussed.

Course Outline

- Essential fundamentals of heat transfer in heat exchanger
- Heat exchanger types and applications
- Design methods and performance evaluation
- Optimization of heat exchangers
- Heat exchanger fouling
- Enhancement of heat transfer
- Compact heat exchangers
- Case studies



COEN-SA-06-05

INDUSTRIAL PUMPS AND FANS: SELECTION, OPERATION AND MAINTENANCE

This course is geared to practicing engineer and covers the various aspects of pump selection, installation, testing, operation and maintenance. Case studies will be selected from various industries according to the interest of course participants.

Course Outline

- **Classification of pumps: centrifugal, displacement**
- **Pump drives, pump control and valves, pump systems**
- **The use of pumps in industry**
- **The selection and purchasing of pumps**
- **Pump installation, operation, maintenance, testing and monitoring**
- **Case studies**

COEN-SA-06-06

VIBRATION BASED PREDICTIVE MAINTENANCE, MACHINE MONITORING AND DIAGNOSTIC SYSTEMS

This course emphasis the practical aspect of lubrication as related to the theoretical foundation. Theory and practice are blended in an attempt to give a solid comprehensive grasp of the field and its impact on industry. It concentrates on systems approach to tackling real lubrication problems and the way to optimize the use of commercial lubricants on the market today.

Course Outline

- **Friction wear and nature of liquids**
- **Simple hydrodynamic theory and elasto-hydrodynamic lubrication**
- **Lubrication additives action**
- **Engine oils specification and performance**
- **Hydraulic oils, performance and problems**
- **Gear oils, recognition of tooth wear pattern**
- **Metal working fluids, greases, selection guide**
- **Circulation - machine tool oils, Oil analysis and interpretation**
- **Synthetics versus minerals, advantages and limitations , Solid lubricants**
- **Case studies.**



This course introduces the fundamental concepts of vibration theory and vibration measurement and analysis methods. Laboratory demonstrations complement the lecture material to give participants hands on experience with modern equipment.

Course Outline

- **Vibration severity measurements: introduction to mechanical vibrations, elements of the measuring system**
- **Frequency analysis of mechanical vibration: dynamic signals, decomposition of complex signals, frequency analysis, types of filters, survey and comparison of available equipment**
- **Introduction of vibration measurements in maintenance programs: initial evaluation, on condition maintenance, system selection and economic evaluation.**
- **Analysis techniques for machine health monitoring: detection of faulty conditions, diagnosis of problems, case histories**
- **Other applications of vibration measurements: single and multi-plane balancing of rotating machinery, design of vibration isolators**
- **Case studies and practical sessions**

The design of an air-conditioning system for a building is usually not unique and the viability of many alternatives has to be evaluated. Thorough the use of special software packages operated on microcomputers, in-depth design and detailed calculations can be easily performed. Participants in this course need to have some background in basic air-conditioning processes.

Course Outline

- **Heat load calculations**
- **Air-conditioning system simulation**
- **Air duct design**
- **Pipe system design**
- **Equipment selection**
- **Economic analysis of possible alternatives**
- **Case studies**



COEN-SA-06-09

**GAS TURBINES: CHARACTERISTICS AND PERFORMANCE
EVALUATION IN THE FIELD**

Major gas turbine applications include aircraft propulsion, oil and gas pipeline pumping, offshore platforms, utility power generation and ship propulsion. The purpose of this course is to introduce the fundamentals of operation, manufacture, maintenance and economics as they apply to the industrial gas turbine engine

Course Outline

- **The gas turbine engine.**
- **Energy transmission in gas turbine engines**
- **Fluid flow in gas turbines.**
- **Gas turbine engine performance and specifications.**
- **Selected topics on gas turbine component design and manufacture gas turbine maintenance**
- **Condition monitoring**
- **Applications and field experience**
- **Case studies**

COEN-SA-06-10

FRICION, WEAR AND LUBRICATION, TRIBOLOGY IN INDUSTRY

This course is tailored for mechanical engineers at all level. The objective of this course is to introduce engineers to the nature of friction and wear and to be able to decide proper solutions for friction and wear problems in industry. Different industrial applications will also be discussed. Audio-Visual materials are available.

Course Outline

- **Historical background, friction theories**
- **Wear mechanisms and theories**
- **Solutions for friction and wear problems**
- **Lubrication theories, thermal effects**
- **Wear failure**
- **Friction induced vibration**
- **Industrial lubricants and additives**
- **Applications**
- **Case studies**



COEN-SA-06-11

FANS, BLOWERS & COMPRESSORS: SELECTION OPERATION, MAINTENANCE AND TROUBLESHOOTING

This course is designed for supervisors, maintenance engineers and maintenance personnel. Participants will learn the various aspects of fan, blowers, and compressors, selection, installation, testing, operation and maintenance.

Course Outline

- Classification of fans and blowers.
- Classification of compressors.
- The use of fans, blowes compressors in industry
- Selection of fans, blowers, and compressors
- Fans, blowers and compressors installation, operation, testing, maintenance, monitoring and troubleshooting.
- Case studies

COEN-SA-06-12

BALL AND ROLLER BEARINGS (SELECTION, GREASING, REPLACEMENT, INSTALLATION AND MAINTENANCE, FAILURE ANALYSIS)

The use of ball and roller bearings in mechanical systems is very common to reduce friction and power losses. This course is designed mainly to familiarize mechanical and maintenance engineers and technicians with all about rolling element bearings including analysis, types, selection, lubrication and greasing, techniques of assembly and disassembly &.Hands-on experience will be given to participants through case studies and practical examples.

Course Outline

- Types, function and elements of ball and rolling bearings
- Analysis of forces and stresses on the bearing
- Bearing calculations and life
- Using the catalog to select the suitable bearing
- Techniques of assembly and disassembly
- Selection of the proper fits
- Lubrication and greasing
- Bearing failure analysis, (Real case studies)
- Bearing installation, mounting and dismounting
- Case Studies



This course is designed to meet the needs of those wishing to acquire a full understanding and experience of the measurements and instrumentation used in mechanical, chemical and hydraulic engineering.

Course Outline

- **Fundamentals of measurement theory**
- **Force, torque and shaft-power measurement**
- **Pressure measurement**
- **Velocity and flow rate measurement**
- **Temperature and heat flux measurement**
- **Manipulation, transmission and recording of data**
- **Case studies**

The course provides the participants with training on performing piping stress analysis by use of CAESAR II software. The introduction of the course covers the basic background of codes and standards, supporting, flexibility and the main features of all piping stress analysis software. The course, then, presents all phases of CAESAR II use including modeling, performing static analysis, review of results, performing equipment code check, design of spring supports and expansion joints, underground pipes, steel structure, and dynamic analysis. The course shall include on-screen lecturing, examples, typical problem solving and hands-on training on the program.

Course Outline

- **Stress Analysis Background**
- **System Modeling**
- **Static Analysis**
- **Equipment Code Compliance**
- **Local Stresses At Nozzle-Vessel Intersection**
- **Design Of Spring Supports**
- **Expansion Joints**
- **Buried Pipes Modeling And Analysis**
- **Steel Structure Modeling And Analysis**
- **Dynamic Analysis**



COEN-SA-06-15

PNEUMATIC ACUTATION AND CONTROL SYSTEMS

This is an intermediate-level course for engineers in charge of industrial equipment that include pneumatic actuation and/or automation. The course covers the basics of pneumatics as well as circuit diagram design and dedicated circuitry. Identification of the sources and causes of malfunction will also be discussed

Course Outline

- **Overview of pneumatic application areas in industry**
- **Pneumatically operated/actuated devices**
- **Pneumatic control elements and components**
- **Conditioning the compressed air**
- **Symbols of pneumatic components and circuits**
- **Connections for simple and repetitive actuations**
- **Sequential actions and the sequence diagram**
- **Dedicated pneumatic circuits**
- **Introduction to electro-pneumatics**
- **Case studies.**

COEN-SA-06-16

DESIGN AND CONSTRUCTION OF PIPING SYSTEMS

This course reviews methodologies used in design of piping systems. Particular emphasis is given to the use of computer software in the analysis of piping systems as well as modern practices and standards.

Course Outline

- **Fluid mechanics: steady flow in networks, flow of gases, two phases flow, unsteady flows water hammer and surge protection**
- **Expansion and flexibility**
- **Hangers and support**
- **Thermal insulation**
- **Manufacture and fabrication**
- **Case studies**



This course covers the operation of the entire control loop (including the sensor, controller, and the process). Measurement and errors. Type of transducers/sensors, categorizations, characteristics, usages, and the way to select the suitable sensor(s) for applications. Signal conditioning. Instrumentation and control components with variety of controllers and control techniques. Monitoring and operation of different processes.

Course Outline

- **Intelligent systems, fundamentals of measurement systems and the structure of typical control loop**
- **Sensors and actuators in automated electro-mechanical systems**
- **Type of sensors/transducers, classification, sensors characteristics (static and dynamic) and selection**
- **Examples of available sensors and their application in modern industrial system**
- **Sensors signal and interfacing requirements**
- **Study of various techniques for sensor integration**
- **Control loop and the role of sensors**
- **Type of controllers and control techniques, and understanding of process dynamics**
- **Common instrumentation networks**
- **Virtual instrumentation and Internet-based (Remote) instrumentation for monitoring and control. Future prospect of instrumentations and intelligence**
- **Case studies**



COEN-SA-06-18

MATERIAL TESTING AND QUALITY CONTROL TOOLS

The objective of the course is to discuss the different quality control tools that are used to ensure that materials conform to the standards. Types of materials, standard specifications, methods of testing and statistical methods used in analyzing results will be discussed.

Course Outline

- **Concept of quality**
- **Types of materials, metals and composites**
- **Standard specifications for testing materials**
- **Mechanical testing of materials according to standard specifications**
- **Statistical tools for quality inspection**
- **Acceptance sampling**
- **Process capability**
- **Case studies and tutorial sessions**

COEN-SA-06-19

**OPERATION AND MAINTENANCE OF GAS AND STEAM
TURBINES**

This course is designed for supervisors, maintenance engineers and maintenance personnel. Participants will learn the various aspects of gas and steam turbines operation and maintenance.

Course Outline

- **Classification of gas and steam turbines**
- **Main components and accessories of gas and steam turbines**
- **Monitoring of gas and steam turbines**
- **Maintenance and troubleshooting of gas and steam turbines**
- **Case studies**