Best Technology Soultions **(BTS)**

Training Program

Mechanical Design Basics For Non-Mechanical Engineers

Training Program

Introduction:

Mechanical engineering in simple terms deals with any equipment that moves; this is what makes it perhaps the most broad and diverse of engineering disciplines. The mechanical discipline essentially derives its breadth from the need to design and manufacture everything from small, even Nano, individual devices, such as measuring instruments, to large systems such as machine tools and power plants. Easy installation and serviceability are critical to the success of a mechanical system as is operational and design flexibility. Understanding parameters governing the selection and design of mechanical systems is essential for identifying suitable systems for a particular application. In order to place all these issues in context, a good working knowledge of mechanical principles combined with a solid understanding of key concepts such as force, energy and heat is important.

Mechanical power transmission is discussed from the point of view of gears, couplings and bearings. Proper selection and sizing of these critical mechanical components is vital to ensuring optimum performance and improved efficiency of a mechanical system. Recently, fluid engineering has undergone significant change and therefore a detailed overview of the underlying principles of fluid power and its applications is vital. The theory behind heat transfer, the various heat transfer mechanisms and the design of heat-exchangers is also examined.

Any study of mechanical systems would be incomplete without including a review of mechanical vibrations. This will help you in monitoring, controlling and analyzing vibrations and in conducting fault diagnoses in mechanical systems. The field of maintenance has evolved into a separate and highly specialized function. An effective maintenance regime helps identify failure symptoms and enables initiation of corrective measures, for preventing unscheduled and sometimes catastrophic failures. Lastly, a discussion on the numerous standards, codes and regulations governing mechanical systems, helps put the whole course into perspective.

Who Should Attend?

Anyone with a need to understand the use, care, installation, or the economics associated with mechanical machinery, Consultants, Consulting engineers, Chemical engineers and technicians, Design engineers, Electrical engineers and technicians, Industrial and commercial plant and facilities engineer, Military personnel, New graduates, Operators, Plant Engineers, Managers and Supervisors, Plant operations and maintenance personnel, Process control Engineers, Technicians and Supervisors, Professionals who want to upgrade their knowledge in mechanical engineering, Project Engineers, Property Managers, Sales Engineers, Service Contractors

Course Objectives:

At the end of this seminar participants will learn about:

- Basic mechanical engineering concepts such as force, work, power, moments and torques
- The importance of common engineering material properties in relation to component life and failure
- Basic design for static strength
- How to select appropriate gears and bearings
- How to perform simple design and selection of piping systems and related components
- How to monitor, control and analyze vibrations
- How to set up an effective but simple inspection and maintenance program (including lubrication)

Course Outline:

Mechanical Engineering Basics

- Introduction and basic concepts
- Units for engineering quantities

- Interpretation of mechanical drawings
- Friction - importance in mechanical systems, types, static and dynamic friction coefficients Engineering Materials
- Stress - strain relationship
- Properties of engineering materials: strength, hardness, ductility and toughness
- Thermal processing of metals and how it affects their properties
- Ferrous and non-ferrous alloys
- Common failure of modes of materials: fracture, fatigue, creep and corrosion

Mechanical Design

- Basic principles
- Factor of safety
- Static equilibrium
- Design for static strength
- Threaded fasteners
- Keys and keyways
- Riveted joints
- Design for fatigue strength

Gears and Bearings

- Gears: terminologies, types, ratios and gear trains
- Gear selection and gearboxes
- Troubleshooting gear problems
- Bearings: loads, types, selection and troubleshooting
- Installation guidelines

Mechanical Drives

- Belt and chain drives

- Mechanical couplings
- Hydrostatic drives
- Hydrodynamic drives
- Torque converters and fluid couplings
- Clutches: types, performance and selection
- Brakes: types, performance and selection

Prime Movers

- What is a prime mover?
- Internal combustion engines
- Electric motors
- Hydraulic and air motors
- Gas turbines
- Mechanical variable speed drives
- Hydraulic and pneumatic cylinders
- Comparative merits/demerits of different prime movers
- Primer mover selection criteria, applications

Fluid Engineering

- Concepts: viscous flow and Reynolds number
- Piping, selection and sizing
- Pumps and valves: types and applications
- Fluid engineering symbols and diagrams
- Analysis of piping systems
- Seals, fittings, flanges gaskets and O-rings
- Mechanical seals: types, selection and maintenance

Theory of Heat Transfer

- Laws of thermodynamics
- Thermal cycles
- Heat exchangers: types, maintenance and troubleshooting
- Heat pumps
- Air conditioning
- Heat: conduction, convection and radiation

Mechanical Vibrations

- Single degree of freedom system
- Terminologies: amplitude, phase and frequency
- Natural frequency of vibration
- Multiple degree of freedom system
- Vibration measurement: sensors, analysers and interpretation
- Use of vibration as a condition monitoring tool
- Troubleshooting and correcting unwanted vibrations

Manufacturing and Production Systems

- Metal production - foundry process
- Cast making and metal melting
- Die and precision casting
- Heat treatment (hardening and softening)
- Hot and cold working of metal
- Presses
- Numerical control
- Machining and metal cutting
- Broaching, shaping and sawing
- Basics of welding and types of welded joints

- Brazing
- CAD/CAM
- Rapid prototyping

Maintenance

- Objectives, reliability and availability
- Breakdown, preventive and predictive maintenance
- Standard practices and tools
- Lubrication
- Factors influencing equipment downtime
- Hazardous failures
- Condition monitoring methods
- Non-destructive testing and inspections
- Planning and inspection schedules

Mechanical Engineering Codes and Standards