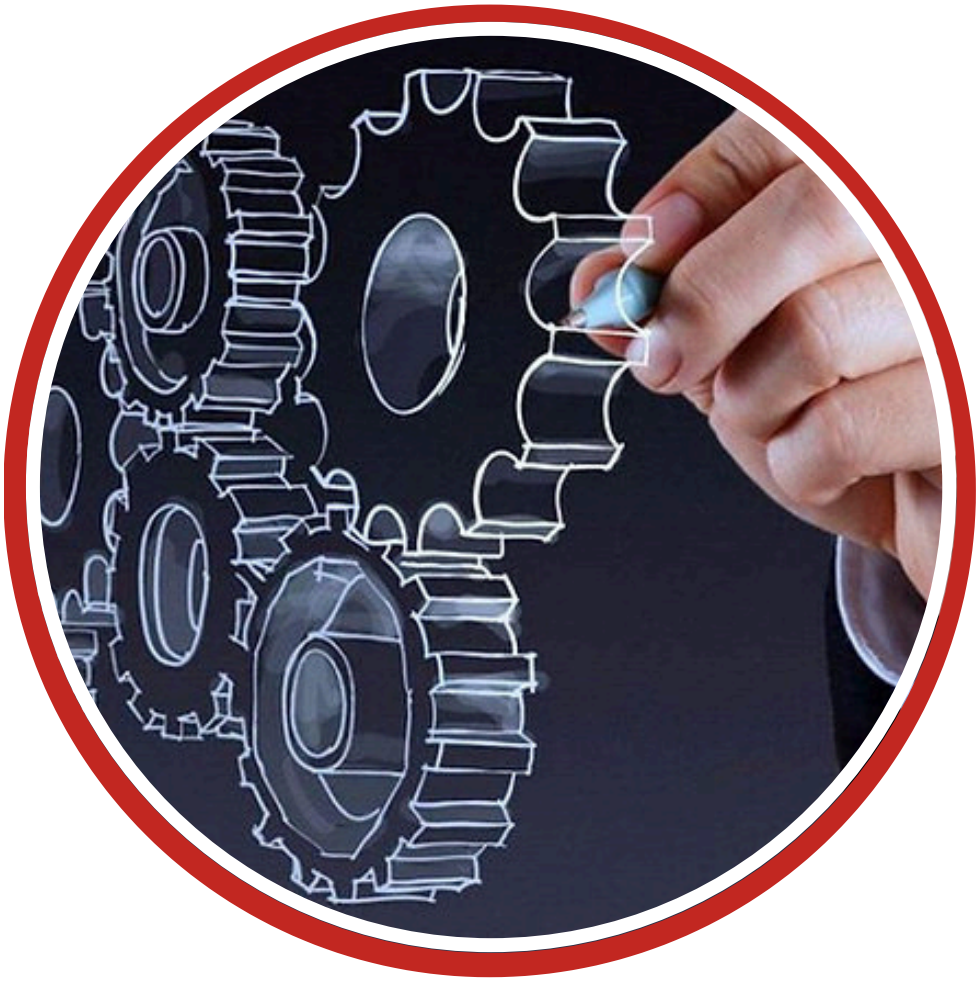
Mechanical Engineering for Non-Mechanical Engineers



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Mechanical Engineering for Non-Mechanical Engineers

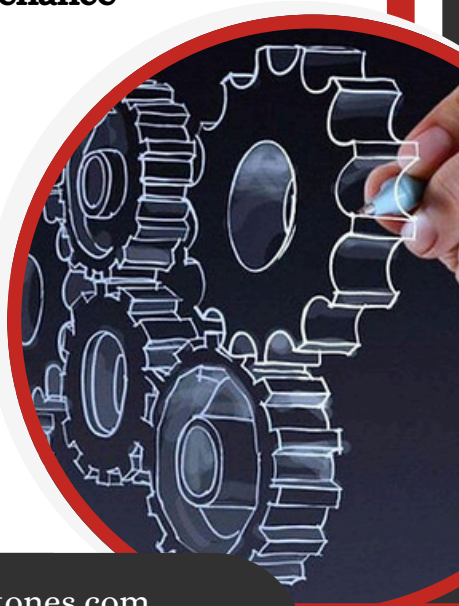
Overview

This course provides non-mechanical engineers and other professionals with an introduction to the core subject areas of mechanical engineering. Engineering as a profession is becoming increasingly multidisciplinary and is also combining with different occupations. People can find themselves working with mechanical engineers without understanding the technical language or the key engineering principles.

Course Objectives

At the end of this course, the participants will be able to

- Basic mechanical engineering concepts such as force, work, power, moments and torques
- The importance of common engineering material properties in 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 analyse vibrations
- How to set up a practical but simple inspection and maintenance program (including lubrication)



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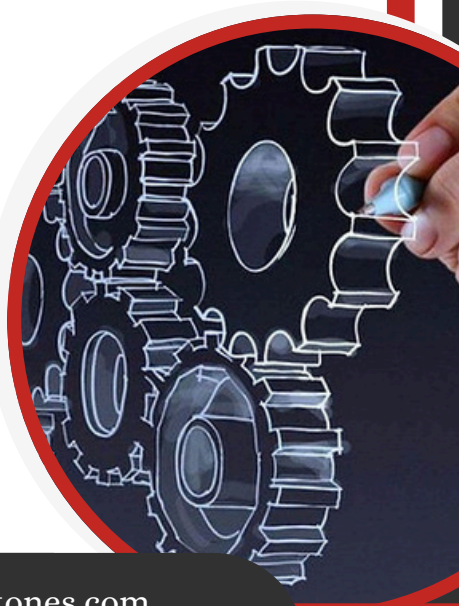
Course Content

1. 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
   - Standard failure modes of materials: fracture, fatigue, creep and corrosion

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

3. 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



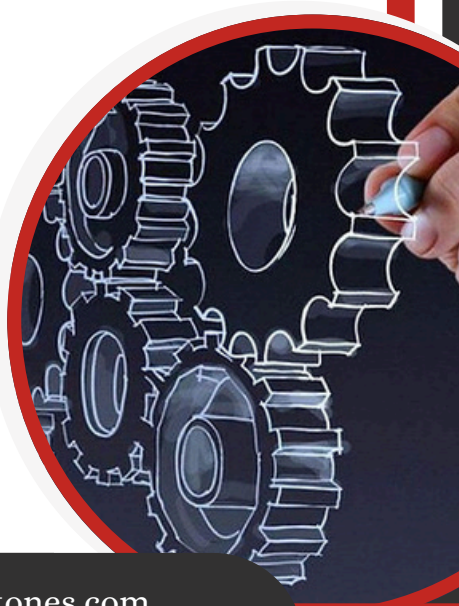
Mechanical Engineering for Non-Mechanical Engineers

Course Content

4. 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

5. 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

6. 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



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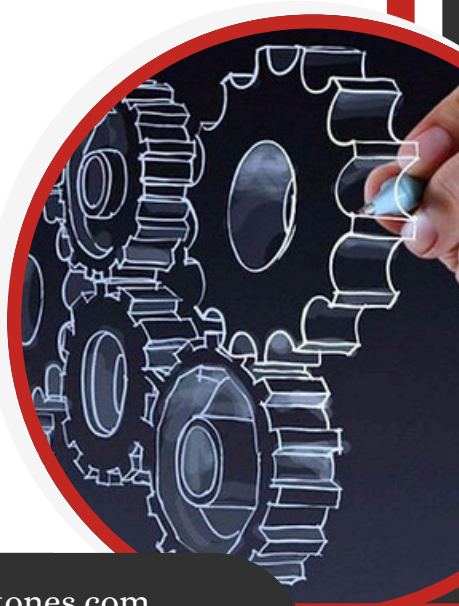
Course Content

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

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

9. 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



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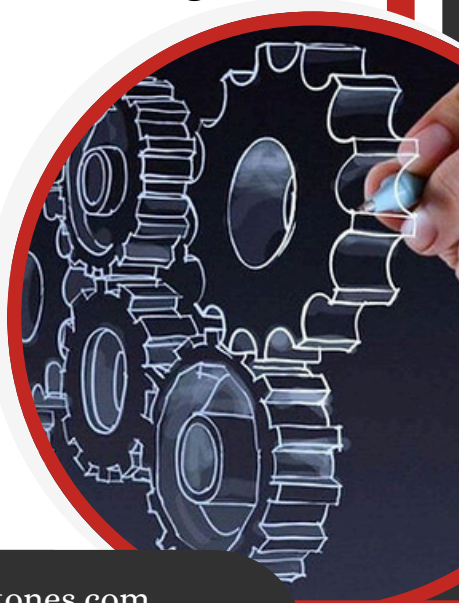
Course Content

10. 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

Targeted Audience

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, 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



Mechanical Engineering for Non-Mechanical Engineers

Course Methodology

Facilitated by an experienced professional trainer, this training course will be conducted as a highly interactive workshop session. A variety of training methodologies and facilitation techniques will be employed before and during the course, as applicable. These methods are aimed at enhancing individual and group interaction while maximising learning. Some of these methods are:

- Online Pre-post Test
- Colourful Visual Aids
- Gamification
- Self-Assessment Instruments
- Simulations
- Case Studies
- Videos
- Group Exercises & Discussions
- Role plays
- Indoor & Outdoor games