COURSE OVERVIEW ME1144-2D
Rotor Dynamics and Bearing Analysis

Course Title
Rotor Dynamics and Bearing Analysis

Course Date/Venue
Please see page 2

Course Reference
ME1144-2D

Course Duration/Credits
Two days/1.2 CEUs/12 PDHs

Course Description

This practical and highly-interactive course includes real-life case studies and exercises where participants will be engaged in a series of interactive small groups and class workshops.

This course is designed to provide participants with a detailed and up-to-date overview of Rotor Dynamics and Bearing Analysis. It covers the rotor dynamics, classification and types of rotor systems and vibration fundamentals in rotating machinery; the critical speeds and mode shapes, bearing types and applications; the bearing forces and their effects on rotor behavior covering load support and force transmission, stiffness and damping characteristics, misalignment and its impact and thermal effects and expansion considerations; and the finite element modeling of rotors, transfer matrix method and system parameter sensitivity analysis.

During this interactive course, participants will learn the response prediction to unbalance, single-plane and multi-plane balancing and field balancing procedures and tools; the instability and nonlinear phenomena in rotors covering oil whip and oil whirl, rub and contact-related instability, gyroscopic and cross-coupling effects and detection and mitigation techniques; the vibration signature analysis, orbit and waterfall plots, shaft centerline and bode plot interpretation and trending and predictive maintenance applications; and the bearing failure modes and root cause analysis for fatigue, wear, and lubrication failure, misalignment and thermal effects, contamination and overload and failure prevention and reliability improvement

Course Objectives

Upon the successful completion of this course, each participant will be able to:-

- Apply and gain a comprehensive knowledge on rotor dynamics and bearing analysis
- Discuss rotor dynamics, classification and types of rotor systems and vibration fundamentals in rotating machinery
- Recognize critical speeds and mode shapes, bearing types and applications
- Identify bearing forces and their effects on rotor behavior covering load support and force transmission, stiffness and damping characteristics, misalignment and its impact and thermal effects and expansion considerations
- Illustrate finite element modeling of rotors, transfer matrix method and system parameter sensitivity analysis
- Apply response prediction to unbalance, single-plane and multi-plane balancing and field balancing procedures and tools
- Identify instability and nonlinear phenomena in rotors covering oil whip and oil whirl, rub and contact-related instability, gyroscopic and cross-coupling effects and detection and mitigation techniques
- Carryout vibration signature analysis, orbit and waterfall plots, shaft centerline and bode plot interpretation and trending and predictive maintenance applications
- Apply bearing failure modes and root cause analysis for fatigue, wear, and lubrication failure, misalignment and thermal effects, contamination and overload and failure prevention and reliability improvement

Exclusive Smart Training Kit - H-STK®

*Participants of this course will receive the exclusive "Haward Smart Training Kit" (**H-STK®**). The **H-STK®** consists of a comprehensive set of technical content which includes **electronic version** of the course materials conveniently saved in a **Tablet PC**.*

Who Should Attend

This course provides an overview of all significant aspects and considerations of rotor dynamics and bearing analysis for mechanical engineers, maintenance engineers and technicians, reliability engineers, rotating equipment specialists, plant and facility engineers, condition monitoring professionals, engineering consultants, project and design engineers and other technical staff.

Course Date/Venue

Session(s)	Date	Venue
1	May 26-27, 2025	Glasshouse Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE
2	July 13-14, 2025	Tamra Meeting Room, Al Bandar Rotana Creek, Dubai, UAE
3	September 15-16, 2025	Glasshouse Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE
4	November 09-10, 2025	Tamra Meeting Room, Al Bandar Rotana Creek, Dubai, UAE

Course Certificate(s)

Internationally recognized certificates will be issued to all participants of the course who completed a minimum of 80% of the total tuition hours.

Certificate Accreditations

Certificates are accredited by the following international accreditation organizations: -

- British Accreditation Council (BAC)

  Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. BAC is the British accrediting body responsible for setting standards within independent further and higher education sector in the UK and overseas. As a BAC-accredited international centre, Haward Technology meets all of the international higher education criteria and standards set by BAC.

- The International Accreditors for Continuing Education and Training (IACET - USA)

  Haward Technology is an Authorized Training Provider by the International Accreditors for Continuing Education and Training (IACET), 2201 Cooperative Way, Suite 600, Herndon, VA 20171, USA. In obtaining this authority, Haward Technology has demonstrated that it complies with the **ANSI/IACET 2018-1 Standard** which is widely recognized as the standard of good practice internationally. As a result of our Authorized Provider membership status, Haward Technology is authorized to offer IACET CEUs for its programs that qualify under the **ANSI/IACET 2018-1 Standard**.

  Haward Technology's courses meet the professional certification and continuing education requirements for participants seeking **Continuing Education Units** (CEUs) in accordance with the rules & regulations of the International Accreditors for Continuing Education & Training (IACET). IACET is an international authority that evaluates programs according to strict, research-based criteria and guidelines. The CEU is an internationally accepted uniform unit of measurement in qualified courses of continuing education.

  Haward Technology Middle East will award **1.2 CEUs** (Continuing Education Units) or **12 PDHs** (Professional Development Hours) for participants who completed the total tuition hours of this program. One CEU is equivalent to ten Professional Development Hours (PDHs) or ten contact hours of the participation in and completion of Haward Technology programs. A permanent record of a participant's involvement and awarding of CEU will be maintained by Haward Technology. Haward Technology will provide a copy of the participant's CEU and PDH Transcript of Records upon request.

Course Fee

US$ 2,750 per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Course Instructor(s)

This course will be conducted by the following instructor(s). However, we have the right to change the course instructor(s) prior to the course date and inform participants accordingly:

Mr. Karl Thanasis, PEng, MSc, MBA, BSc, is **Senior Mechanical & Maintenance Engineer** with over **45 years** of extensive industrial experience within the **Power & Water Utilities** and other **Energy Sectors**. His wide expertise includes **District Cooling Plant**, **District Cooling Plant Operations**, **HVAC** Basics, **HVAC&R**, **KOTZA**, **Refrigeration**, **Modern HVAC & Refrigeration Systems Design, Utilization, Operation & Effective Maintenance, Control Valve & Actuators**, **Fire Safe Valves**, **Piping & Pipeline**, Maintenance, Repair, **Shutdown**, **Turnaround & Outages**, **Maintenance & Reliability** Management, **Mechanical Maintenance** Planning, Scheduling & Work Control, Advanced Techniques in **Maintenance** Management, **Predictive & Preventive** Maintenance, **Maintenance & Operation Cost Reduction** Techniques, Reliability Centered Maintenance (**RCM**), **Machinery Failure** Analysis, **Rotating Equipment Reliability** Optimization & Continuous Improvement, **Material Cataloguing**, **Mechanical & Rotating Equipment** Troubleshooting & Maintenance, **Root Cause Analysis & Reliability** Improvement, **Condition** Monitoring, **Root Cause Failure Analysis** (RCFA), **Steam Generation**, **Steam Turbines**, **Power Generator Plants**, **Gas Turbines**, **Combined Cycle Plants**, **Boilers**, **Process Fired Heaters**, Air Preheaters, Induced Draft Fans, All Heaters Piping Work, Refractory Casting, Heater Fabrication, Thermal & Fired Heater Design, **Heat Exchangers**, Heat Transfer, Coolers, **Power Plant** Performance, Efficiency & Optimization, **Storage Tank** Design & Fabrication, **Thermal Power Plant** Management, **Boiler & Steam** System Management, **Pump** Operation & Maintenance, **Chiller & Chiller Plant** Design & Installation, **Pressure Vessel**, **Safety Relief Valve** Sizing & Selection, **Valve** Disassembling & Repair, Pressure Relief Devices (**PSV**), **Hydraulic & Pneumatic** Maintenance, Advanced **Valve** Technology, **Pressure Vessel** Design & Fabrication, **Pumps**, Turbo-Generator, Turbine **Shaft Alignment**, **Lubrication**, Mechanical **Seals**, Packing, **Blowers**, **Bearing** Installation, **Couplings**, **Clutches** and **Gears**. Further, he is also versed in **Wastewater Treatment** Technology, **Networking** System, **Water Network Design**, Industrial **Water Treatment** in Refineries & Petrochemical Plants, **Piping** System, Water Movement, Water Filtering, Mud Pumping, **Sludge Treatment** and **Drying**, **Aerobic Process** of **Water Treatment** that includes **Aeration**, **Sedimentation** and **Chlorination Tanks**. His strong background also includes **Design** and **Sizing** of all **Waste Water Treatment Plant Associated Equipment** such as **Sludge Pumps**, **Filters**, **Metering Pumps**, **Aerators** and **Sludge Decanters**.

Mr. Thanasis has acquired his thorough and practical experience as the **Project Manager**, **Plant Manager**, **Area Manager - Equipment Construction**, **Construction Superintendent**, **Project Engineer** and **Design Engineer**. His duties covered **Plant Preliminary Design**, **Plant Operation**, **Write-up** of **Capital Proposal**, **Investment Approval**, **Bid Evaluation**, **Technical Contract Write-up**, **Construction** and **Sub-contractor Follow up**, **Lab Analysis**, **Sludge Drying** and **Management** of **Sludge Odor** and **Removal**. He has worked in various companies worldwide in the **USA**, **Germany**, **England** and **Greece**.

Mr. Thanasis is a **Registered Professional Engineer** in the **USA** and **Greece** and has a **Master's** and **Bachelor's** degree in **Mechanical Engineering** with **Honours** from the **Purdue University** and **SIU** in **USA** respectively as well as an **MBA** from the **University of Phoenix** in **USA**. Further, he is a **Certified Internal Verifier/Trainer/Assessor** by the **Institute of Leadership & Management** (**ILM**) a **Certified Instructor/Trainer** and has delivered numerous trainings, courses, seminars, workshops and conferences worldwide.

Training Methodology

All our Courses are including **Hands-on Practical Sessions** using equipment, State-of-the-Art Simulators, Drawings, Case Studies, Videos and Exercises. The courses include the following training methodologies as a percentage of the total tuition hours:-

30% Lectures
20% Practical Workshops & Work Presentations
30% Hands-on Practical Exercises & Case Studies
20% Simulators (Hardware & Software) & Videos

In an unlikely event, the course instructor may modify the above training methodology before or during the course for technical reasons.

Accommodation

Accommodation is not included in the course fees. However, any accommodation required can be arranged at the time of booking.

Course Program

The following program is planned for this course. However, the course instructor(s) may modify this program before or during the course for technical reasons with no prior notice to participants. Nevertheless, the course objectives will always be met:

Day 1

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Introduction to Rotor Dynamics*** *Basic Definitions & Importance of Rotor Dynamics • Types of Rotors: Rigid versus Flexible • Applications in Industrial Machinery • Overview of Dynamic Behavior in Rotating Systems*
0930 - 0945	*Break*
0945 – 1045	***Classification & Types of Rotor Systems*** *Single-Mass & Multi-Mass Rotor Systems • Overhung versus Between Bearing Rotors • Disk & Shaft Modeling • Critical Speed Implications for Different Configurations*
1045 - 1145	***Vibration Fundamentals in Rotating Machinery*** *Vibration Parameters: Amplitude, Frequency, Phase • Natural Frequency & Resonance • Forced versus Self-Excited Vibrations • Damping & Its Role in Vibration Control*
1145 - 1230	***Critical Speeds & Mode Shapes*** *Definition & Physical Significance of Critical Speed • Whirling & Precession Phenomena • Campbell Diagram Interpretation • Mode Shape Visualization & Measurement*
1230 – 1245	*Break*

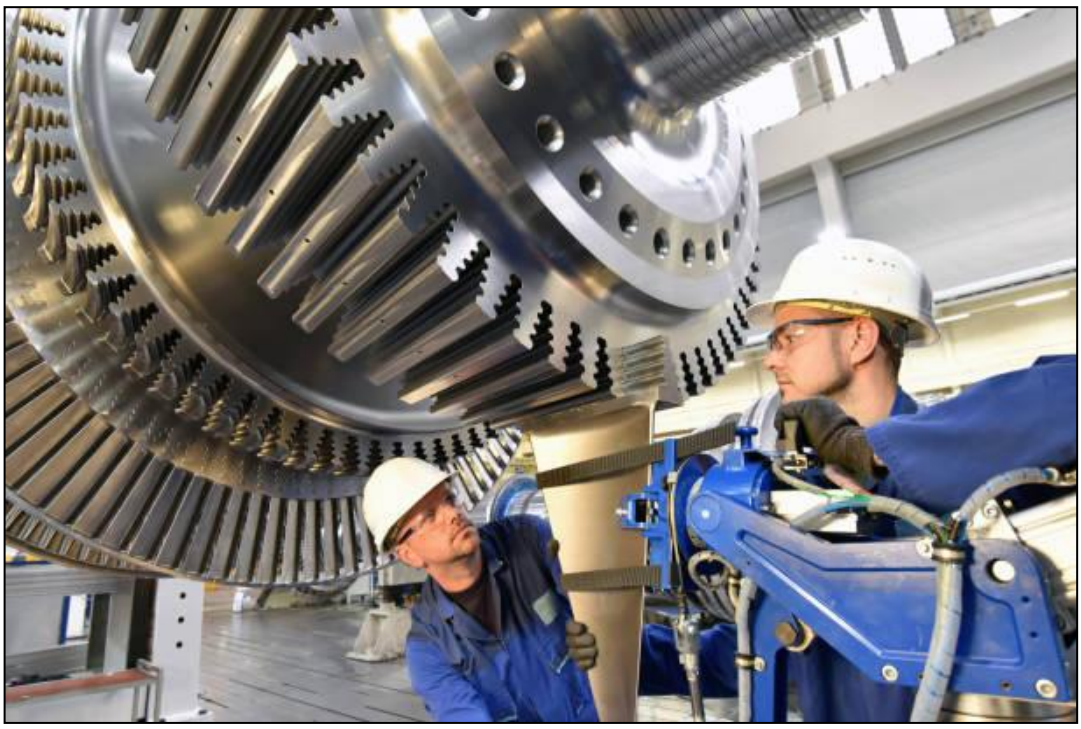
1245 – 1330	***Introduction to Bearing Types & Applications*** *Hydrodynamic Journal Bearings • Rolling Element Bearings (Ball, Roller, Thrust) • Magnetic & Air Bearings Overview • Selection Criteria for Bearings in Rotordynamic Systems*
1330 - 1420	***Bearing Forces & Their Effects on Rotor Behavior*** *Load Support & Force Transmission • Stiffness & Damping Characteristics • Misalignment & its Impact • Thermal Effects & Expansion Considerations*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day One*

Day 2

0730 – 0830	***Rotor-Bearing System Modeling Techniques*** *Lumped Mass versus Continuous System Modeling • Finite Element Modeling of Rotors • Transfer Matrix Method • System Parameter Sensitivity Analysis*
0830 – 0930	***Unbalance Response & Balancing Techniques*** *Types & Sources of Unbalance • Response Prediction to Unbalance • Single-Plane & Multi-Plane Balancing • Field Balancing Procedures & Tools*
0930 - 0945	*Break*
0945 – 1030	***Instability & Nonlinear Phenomena in Rotors*** *Oil Whip & Oil Whirl • Rub & Contact-Related Instability • Gyroscopic & Cross-Coupling Effects • Detection & Mitigation Techniques*
1030 - 1130	***Condition Monitoring & Diagnostic Tools*** *Vibration Signature Analysis • Orbit & Waterfall Plots • Shaft Centerline & Bode Plot Interpretation • Trending & Predictive Maintenance Applications*
1130 - 1230	***Bearing Failure Modes & Root Cause Analysis*** *Fatigue, Wear, & Lubrication Failure • Misalignment & Thermal Effects • Contamination & Overload • Failure Prevention & Reliability Improvement*
1230 - 1245	*Break*
1245 - 1300	***Case Studies & Practical Examples*** *Rotor Dynamic Analysis in Steam Turbines • Critical Speed Mapping in Compressors • Bearing Failure Analysis in Motors • Lessons Learned from Real-World Incidents*
1300 – 1315	***Course Conclusion*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Course Topics that were Covered During the Course*
1315 – 1415	***POST TEST***
1415 – 1430	*Presentation of Course Certificates*
1430	*Lunch & End of Course*

Practical Sessions

This practical and highly-interactive course includes real-life case studies and exercises:-



Course Coordinator

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