COURSE OVERVIEW RE0980
Advanced Reliability Engineering

Course Title
Advanced Reliability Engineering

Course Date/Venue
Sesson 1: June 22-26, 2025/Tamra Meeting Room, Al Bandar Rotana Creek, Dubai, UAE
Session 2: October 05-09, 2025/Tamra Meeting Room, Al Bandar Rotana Creek, Dubai, UAE

Course Reference
RE0980

Course Duration/Credits
Five days/3.0 CEUs/30 PDHs

Course Description

This practical and highly-interactive course includes various practical sessions and exercises. Theory learnt will be applied using our state-of-the-art simulators.

This course is designed to provide participants with a detailed and up-to-date overview of Advanced Reliability Engineering. It covers the foundations and key principles of reliability, failure mechanisms and root cause, reliability modeling and probability theory and Weibull analysis and data interpretation; the system reliability modeling and discuss reliability-centered maintenance (RCM), failure modes, effects and criticality analysis (FMECA), fault tree analysis (FTA) and Monte Carlo simulation in reliability; and the reliability growth modeling, availability analysis, lifecycle cost (LCC) and reliability trade-offs, risk-based maintenance (RBM) and condition-based maintenance (CBM) and predictive models.

During this interactive course, participants will learn the reliability-centered spares management, maintenance optimization techniques, RAM analysis and simulation and human reliability and error modeling; the root cause failure analysis (RCFA) frameworks, big data and reliability analytics, machine learning in reliability prediction, prognostics and health management (PHM) and integration with ISO standards; and the design for reliability (DfR), reliability strategy implementation, benchmarking reliability performance and sustainability and reliability.

Course Objectives

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

- Apply and gain an in-depth knowledge on advanced reliability engineering
- Explain foundations and key principles of reliability, failure mechanisms and root cause, reliability modeling and probability theory and Weibull analysis and data interpretation
- Illustrate system reliability modeling and discuss reliability-centered maintenance (RCM), failure modes, effects and criticality analysis (FMECA), fault tree analysis (FTA) and Monte Carlo simulation in reliability
- Discuss reliability growth modeling, availability analysis, lifecycle cost (LCC) and reliability trade-offs, risk-based maintenance (RBM) and condition-based maintenance (CBM) and predictive models
- Identify reliability-centered spares management, maintenance optimization techniques, RAM analysis and simulation and human reliability and error modeling
- Determine root cause failure analysis (RCFA) frameworks, big data and reliability analytics, machine learning in reliability prediction, prognostics and health management (PHM) and integration with ISO standards
- Recognize the design for reliability (DfR), reliability strategy implementation, benchmarking reliability performance and sustainability and reliability

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 advanced reliability engineering for reliability engineers, maintenance engineers and managers, plant engineers / operations engineers, mechanical, electrical and instrumentation engineers, asset integrity and risk management professionals, quality assurance/control engineers, project managers and other technical staff.

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 **3.0 CEUs** (Continuing Education Units) or **30 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 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 **30 years** of extensive industrial experience. His wide expertise includes **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 Fee

US$ 5,500 per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Course Program

The following program is planned for this course. However, the course instructor(s) may modify this program before or during the workshop 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	***Foundations & Key Principles of Reliability*** *Definitions: Reliability, Availability, Maintainability (RAM) • Evolution of Reliability Engineering • Reliability versus Quality versus Safety • Reliability in Lifecycle Management*
0930 – 0945	*Break*
0945 – 1030	***Failure Mechanisms & Root Cause Understanding*** *Mechanical, Electrical, Corrosion and Fatigue Failure Types • Physical, Human and Latent Root Causes • Failure Progression and Early Warning Signs • Use of Cause-and-Effect Diagrams and Fault Trees*
1030 – 1130	***Reliability Modeling & Probability Theory*** *Random Variables and Probability Distributions • Exponential, Weibull, Log-Normal and Normal Distributions • Failure Rate and Hazard Functions • Reliability Function, R(t) and MTBF*
1130 – 1215	***Weibull Analysis & Data Interpretation*** *2-Parameter and 3-Parameter Weibull Models • Censored Data and Plotting Techniques • Shape Parameter Interpretation (β) • Using Weibull for Wear-out versus Early-Life Failures*
1215 – 1230	*Break*

1230 – 1330	***System Reliability Modeling*** *Reliability Block Diagrams (RBD) • Series, Parallel, K-Out-of-N Configurations • Standby Redundancy and Fault Tolerance • Calculating System Reliability*
1330 – 1420	***Reliability-Centered Maintenance (RCM)*** *History and Evolution of RCM • Seven Questions Framework • Failure Modes and Effects Analysis (FMEA/FMECA) • Function-Oriented versus Failure-Oriented Strategies*
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	***Failure Modes, Effects & Criticality Analysis (FMECA)*** *Developing FMECA Worksheets • Severity, Occurrence and Detection Ratings • Risk Priority Number (RPN) versus Risk Matrix • Criticality Analysis for Asset Prioritization*
0830 – 0930	***Fault Tree Analysis (FTA)*** *Logic Gates and Tree Structure • Qualitative versus Quantitative FTA • Probability Calculations through Event Trees • Software Tools for FTA (e.g., CAFTA, PTC Windchill)*
0930 – 0945	*Break*
0945 – 1100	***Monte Carlo Simulation in Reliability*** *Simulation Basics and Random Number Generation • Using Monte Carlo for Life Estimation • Incorporating Uncertainty and Variability • Scenario Modeling and Decision-Making Support*
1100 – 1215	***Reliability Growth Modeling*** *Duane and Crow-AMSAA Models • Cumulative Failure Data Plotting • Tracking Improvements during Testing • Case Studies in Product Development*
1215 – 1230	*Break*
1230 – 1330	***Availability Analysis*** *Inherent, Achieved and Operational Availability • MTBF, MTTR, MDT Definitions • Downtime Analysis and Uptime Maximization • Availability Modeling for Critical Systems*
1330 – 1420	***Lifecycle Cost (LCC) & Reliability Trade-Offs*** *Cost Categories: Acquisition, Operation, Maintenance, Disposal • Influence of Reliability on LCC • Decision-Making Using Net Present Value (NPV) • Case-Based Trade-Off Evaluation*
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 Two*

Day 3

0730 – 0830	***Risk-Based Maintenance (RBM)*** *Concept of Risk in Asset Management • Risk Matrix Design and Application • Identifying High-Risk Assets • Linking Failure Risk with Maintenance Strategies*
0830 – 0930	***Condition-Based Maintenance (CBM) & Predictive Models*** *Sensor-Based Monitoring Systems • Data Interpretation from Vibration, Temperature, Oil, etc. • Predictive Analytics Using Machine Learning • Integration with CMMS and IIoT*
0930 – 0945	*Break*
0945 – 1100	***Reliability-Centered Spares Management*** *Critical Spares Classification (A, B, C, X) • Reliability-Based Inventory Planning • Spares Failure Rate Modeling • Cost-Risk Analysis for Spare Provisioning*
1100 – 1215	***Maintenance Optimization Techniques*** *Reliability-Centered Maintenance (RCM) versus PM Optimization • Optimization Using Failure Mode Effect and Criticality Analysis • Decision Trees for Repair versus Replace • Maintenance Interval Optimization*
1215 – 1230	*Break*
1230 – 1330	***RAM Analysis & Simulation*** *Integration of Reliability, Availability, Maintainability • Software Modeling Tools (e.g., MAROS, Isograph, ReliaSoft BlockSim) • Case Study Modeling of Process Plant • Sensitivity Analysis and Decision-Making*
1330 – 1420	***Human Reliability & Error Modeling*** *Human Error Taxonomy and Causes • Techniques for Human Reliability Analysis (HRA) • Incorporating Human Factors into Risk Models • Mitigation Strategies and Training Improvements*
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 Three*

Day 4

0730 – 0830	***Root Cause Failure Analysis (RCFA) Frameworks*** *Structured RCA Process (Apollo, TapRoot, etc.) • Data Gathering and Evidence Mapping • Event Trees and Logic Diagrams • Corrective and Preventive Action (CAPA) Planning*
0830 – 0930	***Big Data & Reliability Analytics*** *Using Structured versus Unstructured Maintenance Data • Data Preprocessing and Feature Extraction • Reliability Dashboards and KPIs • Reliability Data Repositories and Tagging Systems*
0930 – 0945	*Break*
0945 – 1100	***Machine Learning in Reliability Prediction*** *Regression Models and Classification for Failure Prediction • Decision Trees, Random Forests, Neural Networks • Health Index Calculation and Remaining Useful Life (RUL) • Implementation Challenges and Accuracy Metrics*
1100 – 1215	***Prognostics & Health Management (PHM)*** *Digital Twins for Reliability Forecasting • Failure Prediction and Remaining*

	Useful Life (RUL) Estimation • End-of-Life Planning and Condition-Based Retirement • PHM Case Studies in Rotating Equipment and Electronics
1215 – 1230	*Break*
1230 – 1330	***Case Study: Failure Diagnostics & Data Modeling*** *Data Modeling of Real-World Equipment Failures • Use of Weibull++, JMP, Python or R for Data Analysis • Interpreting Trends and Parameter Fitting • Report Generation for Management*
1330 – 1420	***Integration with ISO Standards*** *ISO 14224 (Equipment Reliability Data) • ISO 55000 (Asset Management) • ISO 31000 (Risk Management) • Application of Standards in Engineering Decisions*
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 Four*

Day 5

0730 – 0830	***Design for Reliability (DfR)*** *Reliability in Product and Process Design • Designing Out Failure Modes Early • Accelerated Life Testing (ALT) and HALT • Design Validation and Qualification Testing*
0830 – 0930	***Reliability Strategy Implementation*** *Developing a Plant Reliability Roadmap • Organization-Wide Culture for Reliability • Linking Operations, Maintenance and Engineering • Role of Leadership and Performance KPIs*
0930 – 0945	*Break*
0945 – 1100	***Benchmarking Reliability Performance*** *Internal versus External Benchmarking • Key Reliability Indices (OEE, MTBF, MTTR, Availability) • Performance Benchmarking Tools • Gap Analysis and Continuous Improvement*
1100 – 1215	***Sustainability & Reliability*** *Reliability's Role in Energy Efficiency and Emissions • Sustainable Maintenance Practices • Equipment Lifecycle Extension • Case Studies in Circular Maintenance Economy*
1215 – 1230	*Break*
1230 – 1345	***Workshop: System Modeling & Strategy Presentation*** *Group Activity Using Real/Fictional Case • Develop a Reliability Model for a Plant/System • Identify Critical Equipment and Strategy • Present Solution and Get Peer/Instructor Feedback*
1345 – 1400	***Course Conclusion*** *Using this Course Overview, the Instructor(s) will Brief Participants about t Topics that were Covered During the Course*
1400 – 1415	***POST-TEST***
1415 – 1430	*Presentation of Course Certificates*
1430	*Lunch & End of Course*

Simulator (Hands-on Practical Sessions)

Practical sessions will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using the "MS Project", "Mindview Software", "MTBF Calculator" and "ManWinWin Express CMMS Software".

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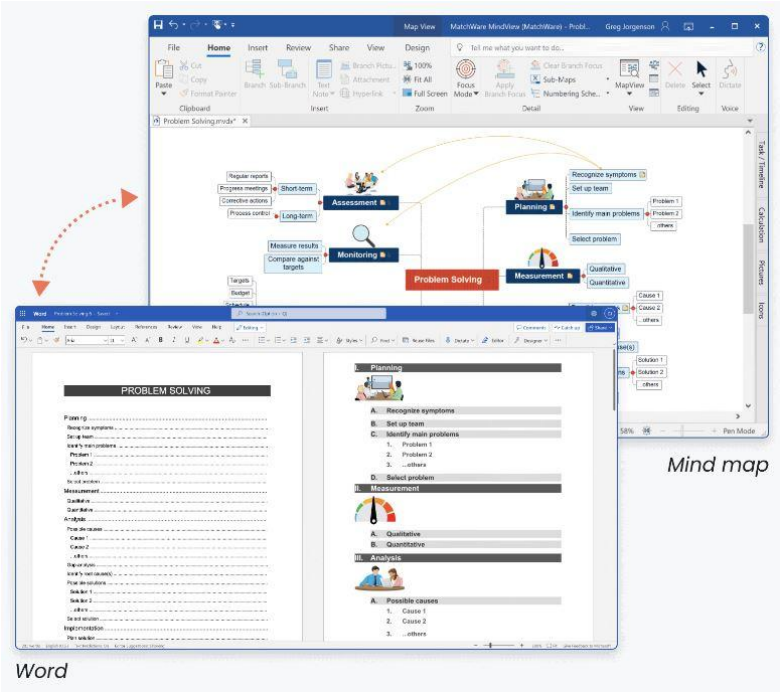
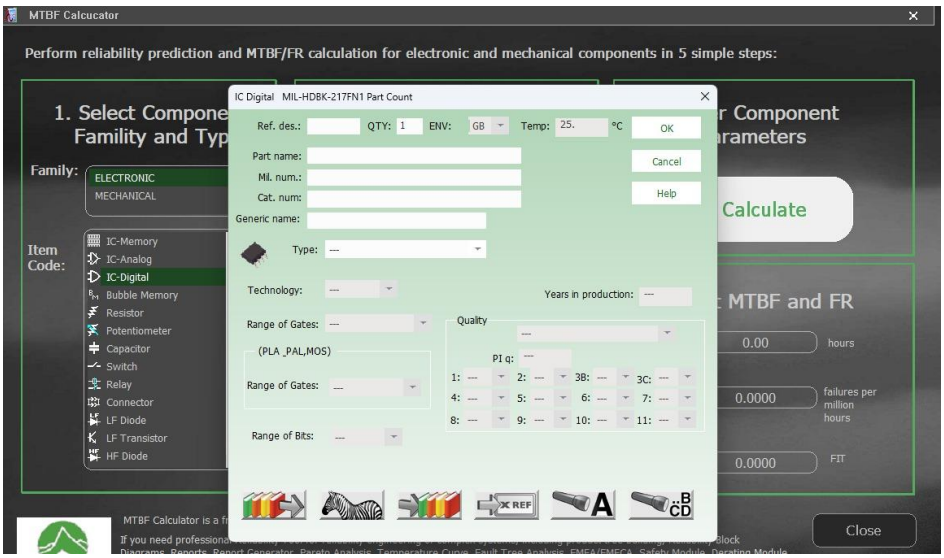
Microsoft Office Project

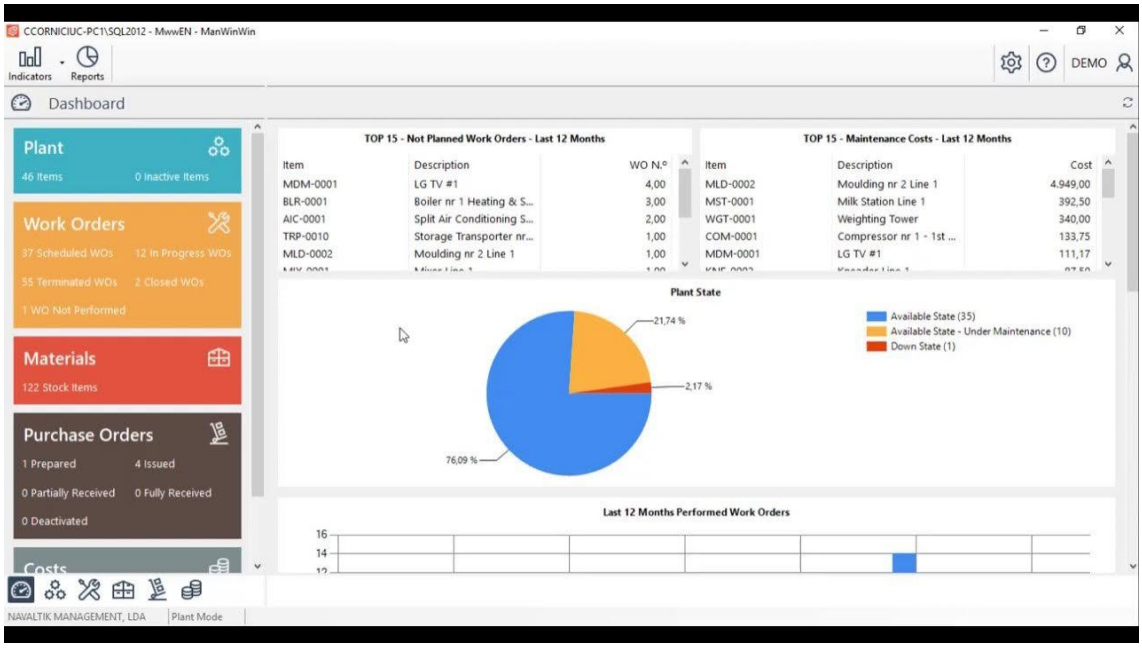
Enterprise Project Management Solution



Mindview Software



MTBF Calculator



ManWinWin Express CMMS Software

Course Coordinator

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