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Reliability and Condition Monitoring Short Courses are extracts from the Mobius Institute Asset Reliability Practitioner [ARP] courses and *iLearnReliability* suite of lessons. They are a great way to learn about individual topics ŀű è2dzǊ 2øƴǈŀŌŜ and time.

- Courses are pre-recorded video lessons, accessed on-line.
- There is no printed material or exam.
- The access period is 3 months from enrollment.

Topics are:

- **Asset Reliability Transformation**
- **End Reactive Maintenance**
- **Asset Criticality and Pareto Analysis**
- **The Economics of Reliability**
- **Reliability Engineering Analytics**
- **Asset Strategy Development**
- **Precision and Proactive Maintenance**
- **Work and Spares Management**
- **Condition Monitoring and Condition-based Maintenance**
- **Precision Field Balancing**
- **Precision Shaft Alignment**

1. Asset Reliability Transformation

Summary: An overview of asset reliability transformation [ART] – a roadmap to reliability improvement. Approximate Course duration: 2 hours

For many years, people have been trying to improve reliability in industrial facilities. Some have had success, but many have not. In the worst-case, programs were cancelled by senior management, and the personnel were asked to leave the organization. But in many cases, programs either fail to get off the ground in the first place, delivered marginal value, or simply faded away over time.
Based on many years of experience and input from several successful asset management practitioners and industry experts, Mobius Institute has developed the Asset Reliability Transformation ART process. This course provides a detailed overview of the ART process, designed to provide detailed structure to your improvement efforts. These lessons are extracted from the Asset Reliability Practitioner ARP-L course for Reliability Program Leaders.

2. End Reactive Maintenance

Summary: How to break out of a "reactive maintenance cycle of doom" to gain control over unplanned breakdowns. Approximate Course duration: 3 hours

Reactive maintenance is costly and dangerous. You need a plan to end reactive maintenance – it will not end simply because you have decided to implement condition monitoring, work management, or you have a new asset strategy. You need to tackle reactive maintenance head-on. You need to treat it like a fire, not by improving your firefighting skills, but by removing the fuel and oxygen.

3. Asset Criticality and Pareto Analysis

Summary: How to do Asset criticality ranking & the use of Pareto analysis. Approximate Course duration: 3 hours

The Asset Criticality Ranking and Pareto analysis are two powerful and easy to generate metrics that enable you to prioritize everything you do with your reliability improvement program. Rather than having to think about the 10,000 assets in your plant, you can focus on one – the most critical asset. Next, you focus on the second asset in the list. And so on. These lesson modules were taken from the Asset Reliability Practitioner ARP-E course for Reliability Engineers, but it is also important for condition monitoring managers, the Reliability Program Leader, the Maintenance Manager, and anyone else involved with spares management and work management (planning and scheduling).

4. The Economics of Reliability

Summary: Learn about Financial justification, Return on Investment (ROI), the time value of money, discounted payback period, cost of capital, assessing financial performance. Approximate Course Duration: 3 hours

- The only way to gain, and retain, senior management support is to determine the financial benefits of the initiatives. Even though it may make "common sense" to improve reliability, and even though you may be able to identify a dozen technical reasons for improving reliability, senior management are primarily interested in the business opportunity in financial terms – that is what their responsibilities are, achieving maximum benefit for shareholders and/or owners (or delivering the required services within a defined budget).
- Whether you need the language of economics to justify the entire initiative, or for investments, you do need to understand the language of finance of you wish to make a positive impression on management and gain their support.
- This course has been extracted from the Asset Reliability Practitioner (ARP) Reliability Program Leader ARP-L course; therefore, it is perfect for anyone who wishes to successfully implement a reliability improvement program or gain approval for any project. In addition, understanding basic finance is a key step toward all management roles.

5. Reliability Engineering Analytics

Summary: Learn about the importance of data, failure rate, MTBF, data distribution, Weibull analysis, Reliability Block Diagrams and making decisions using reliability data. Approximate Course duration: 6 hours

- While there is an almost endless number of practical improvements that can be made to improve reliability, a data-driven approach will help to ensure that opportunities for improvement can be revealed, justified, and defended.
- This course takes a practical approach to a theoretical subject. This is not the best course if you are interested in product quality or if you wish to use this course so that you may immediately utilize advanced analysis software. This course will provide a reliability engineering or senior condition monitoring specialist an excellent introduction to the subject. You will then be in the best position to decide if it is an area that you should invest in for your plant.
- You will learn about statistical analysis (which will also help you understand the new world of machine learning), data distributions (Normal/Gaussian and Pareto), the pros and cons of utilizing MTBF, how to prove the value of your program, plus an introduction to reliability block diagrams, Monte Carlo analysis, and more. You will certainly understand the "bath-tub curves" (failure patterns) and the theory behind RCM and condition monitoring – you may be surprised by what you learn!

6. Asset Strategy Development

Summary: How to develop an Asset strategy - using a master asset list (MAL), bill of materials (BOM), FMECA (Failure Modes, Effects and Criticality Analysis), RCM (Reliability Centered Maintenance) and PMO (Preventive Maintenance Optimization). Approximate Course duration: 8 hours

- Every reliability (and maintenance) improvement program must utilize a technique that establishes an effective maintenance strategy: the right balance of condition-based maintenance, time-based maintenance, and other elements. Unfortunately, in many plants, the maintenance strategy (and the condition monitoring plan) simply evolve over time. As a result, there are tasks and tests performed that either add no value, provide little value, or in some cases, harm the equipment.
- In this course you will learn how to develop an asset strategy. After a detailed overview of the process, and after describing some of the fundamental components that must be in place (a master asset list, bill of materials, a CMMS, etc.), we will cover four tools that will help you establish the asset strategy.
- First, we will begin with a detailed summary of fault tree analysis (also known as causal tree analysis). While this technique is not used to develop the asset strategy specifically, it is a powerful tool that supports FMECA and RCM (and RCA, which is covered in a separate course).
- Next, we will discuss Failure Modes, Effects, and Criticality Analysis (FMECA). This is a powerful tool that enables you to identify each of the tasks must be performed to ensure that failures are kept to a minimum. This technique is often used when performing root cause analysis, and it should be used during the design phase of new projects to ensure that the lifecycle costs are kept to a minimum.
- Next, we will all discuss Reliability Centered Maintenance (RCM). Some would argue that FMECA is a subset of RCM, but for sure, if you wish to be successful with RCM it helps a great deal to be familiar with FMECA.
- And finally, we will cover Preventive Maintenance Optimization (PMO).

7. Precision and Proactive Maintenance

Summary: Precision is a foundation of Reliability. Learn about precision lubrication, contamination control, precision shaft alignment, rotor balancing, mechanical and electrical fastening, 5S and the visual workplace. Approximate Course duration: 4 hours

- If you have rotating machinery, they must be precision lubricated, aligned, balanced, and fastened if you wish to achieve the longest trouble-free life and the lowest maintenance costs. This course provides a detailed summary of each of these technical areas.
- Thanks to the use of the Mobius Institute simulations and animations, you will find it very easy to understand each of these technical topics.

8. Work and Spares Management

Summary: The basics of prioritising work, maintenance planning, scheduling, executing jobs, spares selection and storage or spare. Approximate Course duration: 3 hours

- Work management (planning and scheduling) is a core component of a reliability improvement program. You certainly cannot have an effective condition monitoring program if you do not have an effective work management program. Likewise, you cannot have an effective work management program unless you have effective spares and materials management.
- This minicourse is not intended to provide detailed training on how to perform planning and scheduling or spares management. It simply provides a detailed overview so that you understand "what good looks like."
- These lesson modules were taken from the Asset Reliability Practitioner ARP-E course for Reliability Engineers, but this course will also be of interest to maintenance managers, planners/schedulers, storeroom management, and condition monitoring practitioners.

9. Condition Monitoring and Condition-based Maintenance

Summary: Using Vibration analysis, ultrasound, oil analysis, infrared thermography, visual inspections, performance monitoring, non-destructive testing (NDT) and electrical equipment testing to determine the health of assets. Approximate Course duration: 5 hours

- Condition monitoring plays a key role in the reliability improvement program. At the least, it is used to provide a warning of future failures so that corrective maintenance can be planned. In a true reliability-based maintenance program, condition monitoring is an integral part of the planning and scheduling process. In a more enlightened program, it is used to detect the root causes of failure so they may be avoided, and it is used for quality assurance and quality control (acceptance testing when purchasing new equipment and for verifying the quality of work performed on-site).
- This course provides a summary of the major technical areas of condition monitoring: vibration analysis, ultrasound analysis, oil analysis and wear particle analysis, infrared thermography, inspections, performance monitoring, NDT, and electrical equipment testing (including electric motors and transformers – additional electrical applications are covered under ultrasound and infrared thermography).
- Thanks to the use of the Mobius Institute simulations and animations, you will find it very easy to understand the condition monitoring technologies.
- These lesson modules were taken from the Asset Reliability Practitioner ARP-E course for Reliability Engineers, but this course will also be of interest to maintenance managers (and planners/schedulers) and condition monitoring practitioners.

10. Precision Field Balancing

Summary: Achieving precision balancing for rotating equipment.
Approximate Course duration: 4 hours

Unbalance in machinery puts excessive load on bearings and all other components, including the machine structure itself. The unbalance forces also excite resonances, cause looseness and fatigue failure, generate noise, and in certain circumstances, result in poor product quality. Machines that are out of balance consume more energy. The Precision Field Balancing course is highly visual and filled with animations that make everything crystal clear. This course provides step-by-step training, one slide at a time.

11. Precision Shaft Alignment

Summary: Precision shaft alignment and soft foot elimination. Approximate Course duration: 5 hours

Precision alignment is one of the primary tools for maximizing the reliability of rotating machinery. Just the smallest amount of angle or offset between two shafts will result in excess load on the bearings, seals, shaft, and coupling. In addition, the vibration generated can result in accelerated failure of other machine components and the supporting structure. It is essential that you precision align your rotating machinery and eliminate soft foot. This course is highly visual and filled with animations that make everything crystal clear. Although modern laser alignment systems are also quite visual, in many cases that means that the person performing the alignment does not have a complete appreciation of what is happening as they make the various adjustments. The alignment training provides step-by-step training, one slide at a time.

To enquire about this or other Distance Learning or Classroom training options.
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