Arrelic®
Your Reliability Partner.

Training programme on

Predictive Maintenance (PdM)
TECHNIQUES FOR ENGINEERS

arrelic.com

Course Code - 9050

ABOUT

OUR COMPANY

We help manufacturing companies reduce their operation and maintenance costs through technological innovation in Asset Performance Management, Reliability Engineering, Predictive Maintenance, Industry 4.0, AI & ML and Skill Development.

OUR SERVICES

Asset Performance Management

IIoT Products and AI/ML Platform

Reliability Engineering

Industry 4.0 Digital Transformation

Predictive Maintenance

Remote Monitoring For Industrial Assets

OUR VALUE TO CLIENTS

- 25% Reduction in Maintenance Cost
- 20% Improve in Productivity & Availability
- 80% Reduction in Machine Breakdown
- 70% Reduction in Human Interference

ABOUT

ARRELIC TRAINING

Arrelic is focused to equip both industry professionals and college graduates with the skills and knowledge required for bridging the desired state of workforce which industry needs to compete globally. Arrelic Institute provides over 75 different types of customized training programs in the field of Reliability Engineering, Asset Management, Best Practice, Operation & Maintenance, Predictive Maintenance, NDT, Predictive Analytics, Quality, Risk & Safety.

Arrelic conducts public trainings and workshops in 38 locations across India and 10+ International locations. We are working for large corporate house from 15 different types of industries ranging from Airlines, Automobiles, Cement, Defence Manufacturing, FMCG, Glass, Marine, Metals, Mining, Oil & Gas, Power, Pulp & Paper, Facility Management and Fertilizer.

ARRELIC TRAINING : AT A GLANCE

175+ Training Modules

06+ Industry Specific Domain

40+ Global Experts

15+ Global Locations

75+ E-Learning Training Modules

05+ University Program

38+ locations in India

15+ Types of Industries

10+ Associations

ARRELIC
CLIENTS

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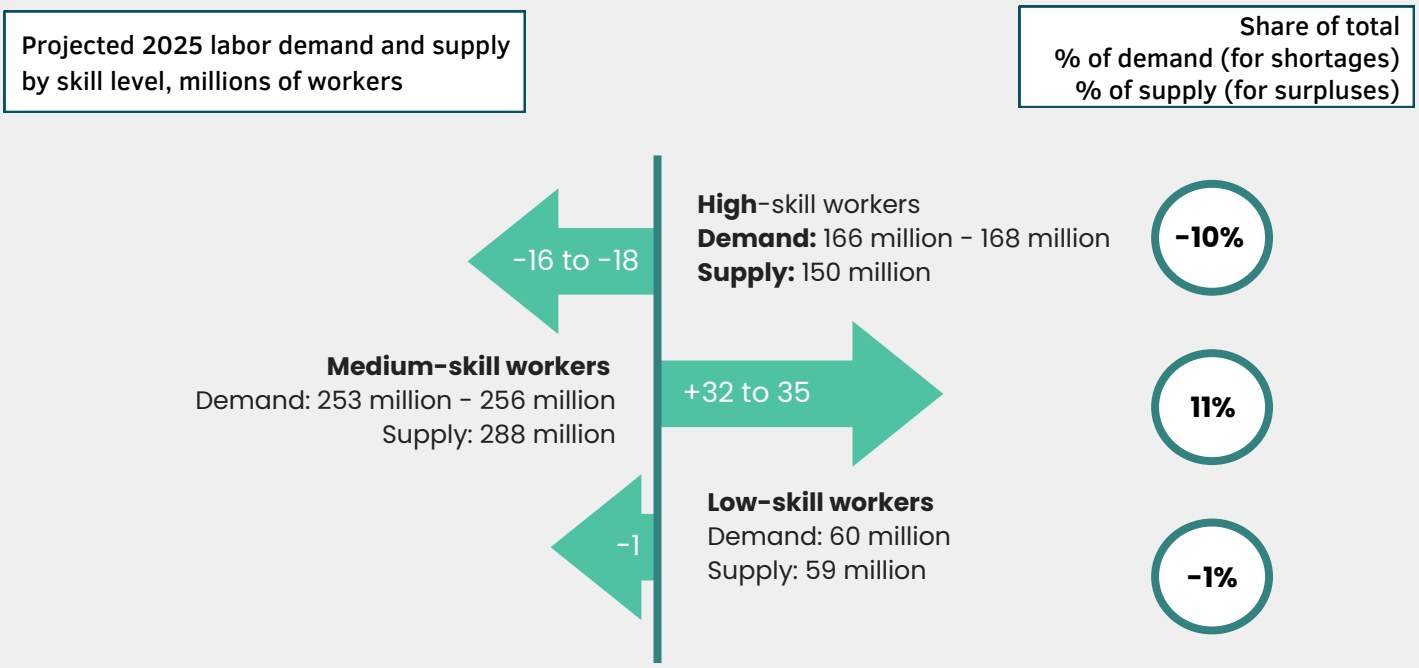
Your Reliability Partner.

PARTICIPANTS

FROM DIFFERENT COUNTRIES

Skill Development
& INDUSTRY NEEDS

By 2025, advanced economies could have too few collage-educated workers and too many workers with secondary degrees.



This data, as researched by a well-known organization reveals that the need of skill-based employees will increase despite the industrial automation. Employees should be more technically oriented rather than a specific orientation towards interpersonal skills.

NEED FOR WORLD CLASS TRAINING

Training is a critical part of a site reliability training program. For professionals dealing with millions of dollars in equipment and the responsibility of keeping that equipment running effectively and efficiently, training is necessary to enhance their competency and eliminate equipment downtime.

The most effective plant managers know that the return of investment for training programs is well worth the time and money spent, because training results in product quality, cost, and profitability remaining at optimum levels for the organization.

Individuals & workforce are key to maintain a competitive edge. People feel more motivated if their organization invested in skills training. Businesses are 2.5 x more likely to fail if they don't train their staff.

Most employees have some weaknesses in their workplace skills. Errors are likely to occur if the employees lack knowledge and skills required for doing a particular job. A well-trained employee will be well acquainted with the job and will need less of supervision. Thus, there will be less wastage of time and efforts

INDUSTRIES

KEY CHALLENGES

HIGHER BREAKDOWN OR MACHINE DOWNTIME

Companies are facing average of 11% downtime over a year.

POOR EQUIPMENTS AVAILABILITY AND RELIABILITY

Still most of manufacturing industries rely on preventive maintenance rather than Predictive maintenance. Due to this machines have lower reliability.

LACK OF OPERATIONAL EFFICIENCY

Currently industry average OEE - Overall Equipment Effectiveness stands 81% where as the best in class companies are having more than 88%.

LESS USE OF MACHINE DATA FOR DECISION MAKING

Poor data usage may lead to performance lag. Less than 01% machine data used in industry for decision making.

RISING PRODUCTION COSTS

Wrong assessment of assets, lack of better O&M stratergy may lead to rise in production costs.

SKILLS GAP

Companies are increasingly facing a gap in required skilled recourses due to rapid change in technology and complex operations.

COURSE OVERVIEW

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The 60 hours (04 Weeks) course on Predictive Maintenance (PdM) Techniques for Engineers will focus on

- Understanding of plant asset management
- Various Maintenance Strategy
- Organizing maintenance resource
- Selecting the right maintenance work
- Analysing failures such as root cause analysis, defect elimination
- Failure mode, effects and criticality analysis (FMECA),
- Predictive maintenance tools in depth
    - Vibration Analysis
    - In-situ Dynamic Balancing
    - Laser shaft alignment
    - Laser belt alignment
    - IR-Thermography
    - Oil analysis

LEARNING OBJECTIVES & BENEFITS

By attending this technical training on “Predictive Maintenance (PdM) Techniques” delegates will be able to learn and deliver the following things.

- Basic understanding of the plant asset management and develop proactive maintenance management strategy.
- Perform the critical steps in the identification of necessary maintenance work.
- Demonstrate the bottom -line benefits of predictive maintenance tools such as Vibration Analysis, IR-Thermography, Oil analysis.
- Understanding and creating awareness of various losses and KPI (Both Leading and Lagging Indicators)
- Hand holding experience on performing Vibration Analysis, In-situ Dynamic Balancing, Laser shaft alignment, Laser belt alignment, IR-Thermography.
- Achieve streamlined maintenance processes by developing a fool-proof Maintenance skill development program.
- Effectively decrease downtime by reducing the MTTR and enhancing the MTBF .
- Utilize best practice performance management to control your basic Maintenance practice

TARGET AUDIENCE

This course will enhance learnings of Mechanical / Electrical / manufacturing / Production / Industrial engineering graduates. It is important for engineers aiming to pursue careers in the followings areas.

- Engineers – Maintenance
- Engineers – Operation
- Supervisor and Front line Leaders of O & M
- Engineers - Reliability

MECHANICAL ENGINEERING GRADUATES

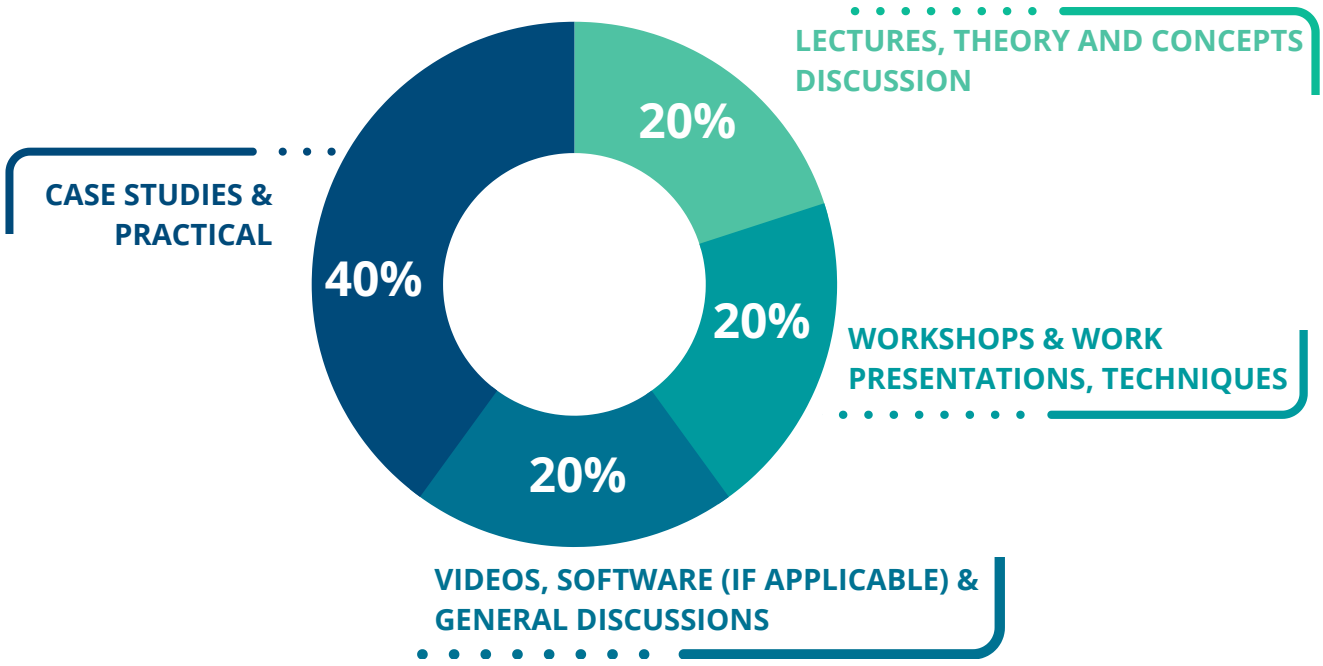
ELECTRICAL ENGINEERING GRADUATES

INDUSTRIAL ENGINEERING GRADUATES

PEDAGOGY

The training session will start with a pre-assessment to gauge the level of awareness of the participants about the course followed by the class room session. The class room session will consist of lectures with structured lessons from the learning manual and engaging power point slides with videos to boost the learning. There will be ongoing discussion with action planning and sufficient time will be given for Q&A. after the classroom session case studies of the relevant course and industry will be discussed which will be succeeded by post assessment and certification event.

Training Methodologies



Assessment & QA Process

- Pre-& Post Assessment: Assessment tasks consist of quizzes, practical discussions, case studies, role plays, on-site exercises etc.
- Certificates: Certificates will be awarded to the learners who complete and pass in the assessments with at least 70%.
- Course Language: English
- Progress Reports: Progress and attendance reports will be sent to the respective employer's reporting manager indicating the progress made towards the training objective.
- Break, Refreshment and Day Plan: There will be two refreshment breaks and lunch at appropriate intervals.
- Training Materials and Handouts: All the training materials, handouts if applicable, Assessment Questions and other case studies will be provided in softcopy either in flash drive or DVD.

07 Key Takeaway

1. "Known Best Practices in Maintenance and Reliability" from around the world.

2. Operator Driven Reliability. Maintenance Work Process Management

3. Barriers and Solutions to Effective Maintenance Management.

4. Maintenance Strategy Development & Reliability Centered Maintenance (RCM)

5. Types of Predictive maintenance tools and it's uses

6. M & R tools such as RCA, FMEA and various Lean Manufacturing tools.

7. Leading & Lagging KPIs, Benchmarking for Proactive Maintenance.

ReliabilityQ Career Center is filled with hundreds of opportunities

Reliability CAREER CENTRE INDUSTRY CONNECT

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COURSE OUTLINE

MODULE 01

Introduction
- Pre-assessment Test

Definition of Modern Maintenance Management
- Key terms and definitions
- Benefits of moving towards precision or reliability Maintenance
- Developing & aligning maintenance vision and mission to corporate business objective

Maintenance Type
- Breakdown Maintenance
- Preventive Maintenance(PM)
- Predictive Maintenance (PdM)/Condition Monitoring
- Mothball (Run to Failure)
- Reliability Centered Maintenance
- TPM/TQM

Risk Based Inspection
- Understanding of PF Curve
- Maintenance failures with Bath tub curve
- Cost of failure
- Predicting failures
- PdM program development

Failure Pattern
- Types of failure pattern
- Common cause of failure in Pump, compressor, motors etc.
- Failure Pattern wITH Pi-chart and other infographics
- Case Study

Cost of Failure & Energy Consumption
- Annual savings calculation
- How machine errors such as Unbalance, misalignment, assembly errors impact in energy consumption of the plant ?

Operator Driver Reliability / 5S / AM
- 5S
- Data Visualisation
- CLTI Checklist
- ODR – Key Elements

MODULE 02

Introduction to Predictive Maintenance
- CBM/PdM Technologies

Vibration Analysis
- Basics on Vibration
- Terms used in Machine vibration
- Instrumentation and how to use
- Vibration analysis explaining on charts showing CPM Vs RMS
- Basics on data interpretation
- Analysis Methods
- Initiation to the time domain
- FFT
- 1X means what and on which case it will occur
- 2X means what and on what case it will occur
- Multiple peaks and on what case it will occur
- Where to measure temperature and what is its importance
- Why to measure speed of shaft and what is its importance
- Vibration alarm limits and precision levels explain with case studies

Performing Vibration Analysis

Fitting Housing And Shaft
- Fits and tolerances basics
- Precision Measurement Tools
- Error Prevention, Determine proper shaft and bearing fit
- Problems with Housings and Shafts
- Theory on precision measurement instruments Basics such as Micrometre, Vernier calliper, Dial gauge, Bore gauge , feeler gauge, Depth gauge etc.,

Case Study

#The training topics and content may vary wrt participants interest

MODULE 03

IR-Thermography

- Discuss how thermal imaging systems for mechanical inspection applications
- Apply good mechanical and electrical inspection safety procedures
- Recognize typical thermal patterns associated with mechanical faults
- Collect quality data and account for effects such as distance and emissivity using infrared cameras

Common Machinery Errors

- Pump, Motors, Gearboxes and others
- Assembly machine errors like base bolts inspection, correct installation of bearings, correct installation of key on shafts (key length calculations), Eccentricity on pedestal bearings fitted shaft while tightening set screws etc.,
- Theory on Rough alignment and followed by practical session on doing rough alignment on machine by them and take vibration readings and ampere readings and record
- Theory on soft foot and followed by practical session on correcting soft foot on machine by them and take vibration readings and ampere readings and record
- Bolts and its marking standards like SAE, ASTM and show them bolt torqueing chart

Case Study

MODULE 04

In-situ Dynamic Balancing

- Balancing basics
- Causes of Unbalance?
- Balance standards overview
- Balance tolerance and case study
- Practical session on Balancing with a rotation disc by them
- V-belt & chain drives basics
- Purpose of drives
- Types of drives
- How to store V-belts and its importance
- Show charts on V-belts with practical session

Alignment – Shaft & Belt

- Introduction to Shaft Alignment
- Benefits of Shaft Alignment
- Pre-Alignment Procedures
- Rough Alignment Procedures
- Conducting Horizontal Shaft Alignment - Dial Indicator Method
- Conducting Horizontal Shaft Alignment - Laser Method
- Conducting Vertical Shaft Alignment - Laser Method
- Conducting Machine Train Shaft Alignment - Laser Method
- Case study
- Day Review & QA

Case Study

MODULE 05

Bearings and Coupling

- Introduction to Bearings
- Purpose of bearings
- Bearing life calculations
- Types of bearing
- Bearing failure cases
- Types of coupling
- Common failure patterns for coupling

World Class Lubrication Management

- Lubrication Fundamentals
- Viscosity, Grease types, How to store lube, Lubrication cleanliness international standard and its importance
- Lubrication Calculation and Lubrication charts
- To make proper design to manage various types of machinery lubrication and/or inspection and how to improve the machine reliability using lubrication
- Manage change and/or top-off oil in mechanical equipment found in common industrial sites.
- Contamination control as a way to improve machine performance

Post Assessment and Certificates

#The training topics and content may vary wrt participants interest

PREREQUISITE

Arrelic will provide below Equipments

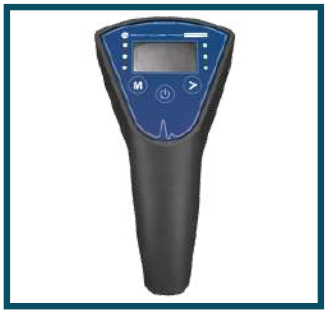
MACHINE VIBRATION BALANCING & ALIGNMENT KIT



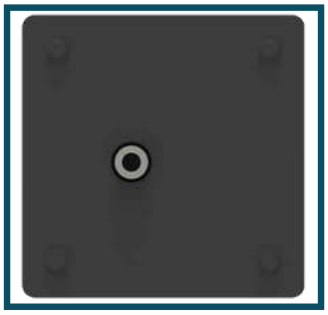
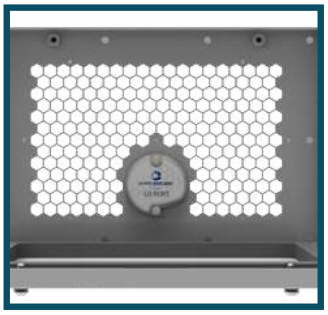

IR THERMOGRAPHY KIT




ULTRASOUND KIT






PRAVAT KUMAR SENAPATY

QUALIFICATION	M. Tech (Mechanical Engineering)
EXPERIENCE	35+
TRAINING HOURS COMPLETED	50+
ARRELIC TRAINERS RATING	9.82

Both Graduation & Post Graduation in Mechanical Engineering from NIT, Rourkela, India.

Served over 35 years in Mechanical maintenance, mainly in the field of Machinery Diagnostics Condition monitoring, Vibration analysis, Oil analysis & NDT) in SAIL, Rourkela Steel Plant, Power and Desalination plant in Bahrain with Ministry of Bahrain and Oil & Gas plants in Qatar with Qatar Petroleum.

Certified Vibration Specialist (Mobius Institute) and Certified Lube oil analyst.

Delivered talks and associated with a number of professional bodies as Life Members.

DOMAIN KNOWLEDGE

Mechanical / Reliability Engineering / CBM/ NDTs

Reliability Centered Maintenance, Failure Analysis, Defect elimination, Condition Monitoring Tools, Vibration Monitoring, Lubricant Analysis, Thermal Imaging, Motor Current Signature Analysis and Non-Destructive Techniques.

Maintenance Excellence & Asset Management

Asset Maintenance Strategy, Safety in Maintenance, Latest maintenance practices, Inspection of Rotating and Stationery Equipment, Static & Dynamic Balancing of Rotating machines, Laser Alignment of Rotating machines.

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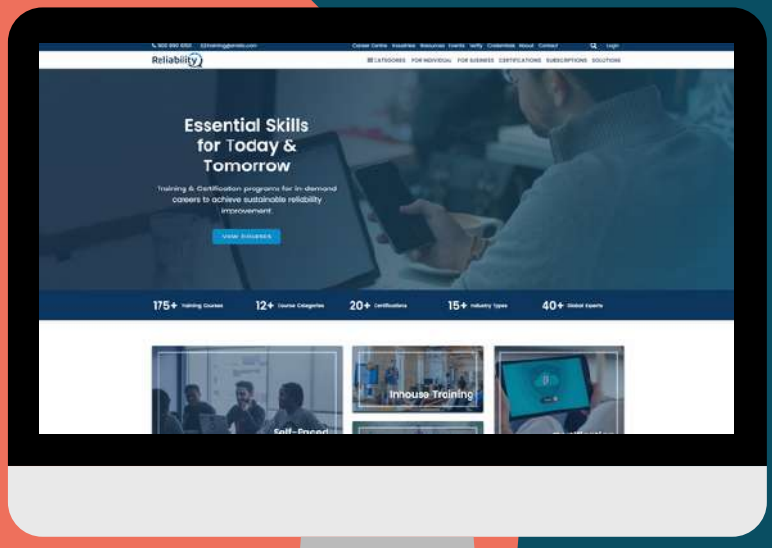
LMS – DIGITAL PLATFORM

AI BASED VIRTUAL E-LEARNING LMS PLATFORM FOR YOUR BUSINESS

RELIABILITYQ PLATFORM FROM ARRELIC

Reliability Q



reliabilityq.com

- **Predictive Maintenance (PdM) Techniques for Engineers** – Basic (Course Code - 9050) certificate with badge verified from **ReliabilityQ** will be awarded from **Arrelic Professional Development Institute (APDI)** to those delegates who attend the entire duration of the training course and pass the post assessment test.
- Verify your certificate – reliabilityq.com/verify

AWARDS & HONOURS

ARRELIC EXPERTISE IN

PREDICTIVE MAINTENANCE (PdM) FOR ENGINEERS

367+
NUMBER OF PARTICIPANTS TRAINED BY ARRELIC

56+
COVER PARTICIPANTS FROM 56+ COUNTRIES

1:12 ROI*
ROI BASED UPON NET SAVING ON PLANT DOWNTIME

4.76
COURSE RATING

STUDENT'S FEEDBACK

4.76
★★★★½
Course Rating

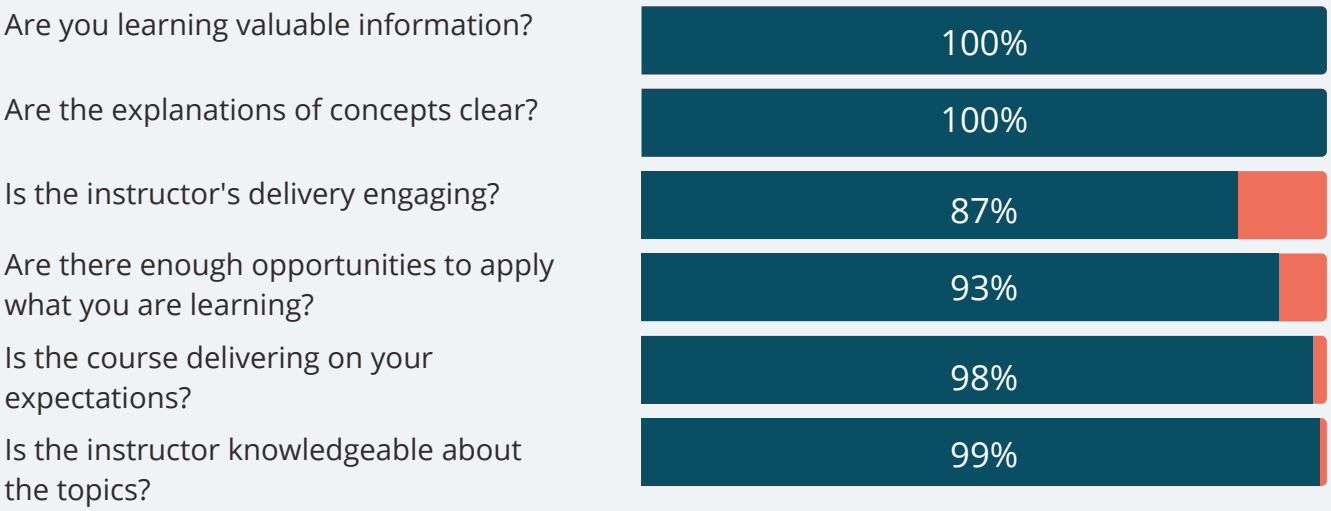
★ 5 — 38%
★ 4 — 57%
★ 3 — 5%
★ 2 — 0%
★ 1 — 0%

TT Tawanda T.
★★★★★
Easy and familiar maintenance language used.

KG Kalukay Nzaila G.
★★★★☆
this course is very helpful for me and it has taught me so many things in my career and specially in planning work experience.

JO Jason O.
★★★★½
In-depth learning experience that are relatable to the engineering field of expertise

COURSE PERFORMANCE



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INDUSTRY


Aerospace & Defence


Automobiles


Cement


Chemical


Facility Management


FMCG


Glass Manufacturing


Metal & Mining


Msme & Small Business


Oil & Gas


Pharmaceuticals


Power


Public Sector


Pulp & Paper


Transport & Logistic

INDUSTRIAL IOT SENSORS

MACHINE ANALYTICS

PREDICTIVE MAINTENANCE

RELIABILITY CONSULTING

EDUCATION & TRAINING

TALENT ACQUISITION

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