20MD012 CONDITION MONITORING AND FAULT DIAGNOSIS OF MACHINERY

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Course Description and Objectives:
To provide a basic understanding with case studies on different condition monitoring techniques and apply them for inspecting machines in accordance with industry specifications and standards. To provide knowledge and enrich ideas about the conventional NDT techniques. Develop a strong hand on experience for inspecting and evaluating components in accordance with industry specifications. To develop a fundamental knowledge about the advanced techniques and the recent developments in non-destructive testing so as to control the quality in manufacturing engineering components.

Course Outcomes:
After successful completion of this course the student will be able to:
  - ➢ Understand the benefits of condition monitoring
  - ➢ Calibrate the instrument and inspect for in-service damage in the components.
  - ➢ Differentiate various defect types and select the appropriate monitoring methods for better evaluation.
  - ➢ Ability to communicate their conclusions clearly to specialist and non-specialist audiences.
  - ➢ Documentation of the testing and evaluation of the results for failure analysis.

UNIT – I   L12

Introduction: System failure, component failure, failure decisions, failure classifications, types of failure, failure investigations, causes of failure, Methods of maintenance – condition based maintenance, preventive maintenance, predictive maintenance, proactive maintenance.

UNIT – II   L12
Condition Monitoring: Need and importance of condition monitoring, the decision to monitor, common monitoring techniques, online/off-line monitoring, commonly measured operating characteristics.

UNIT – III   L12
Signal Processing: Time domain analysis, frequency domain analysis – FFT and power spectrum, time – frequency domain – STFT, Spectrogram, Periodogram. Envelope Analysis, Cepstrum Analysis.

UNIT – IV   L12
Correcting Faults: Common Faults observed in Rotating Machines, Vibration Severity Charts, FFT Analyzer, Counter measures to reduce vibrations – balancing, alignment, resonance vibration control.

UNIT – V   **L12**
Machine learning: Introduction, Need for Machine learning, Trend Analysis – regression and forecasting, Fault Classification – Discriminant Analysis, SVM, ANN, Deep Learning.

TEXT BOOKS:
1. Collacott R.A. "Mechanical Fault Diagnosis and Condition Monitoring", 2nd Edition, Chapman
and Hall,London,2007.
2. Randall R.B., "Vibration based Condition Monitoring: Industrial, Aerospace and Automotive Applications", Wiley Sons & Co., 2010.
3. Mohanty.A.R. "Machinery Conditon Monitoring: Principles and Practices", CRC Press Book, 2014.
REFERENCE BOOKS:
1. Rao B.K.N, "Hand Book of Condition Monitoring", Elsevier Science & Technology, Oxford U.K, 1996.
2. Rao J.S., "Vibratory Condition Monitoring of Machines", Narosa, 2000.