

Course Code	Course Name	Credits
<b>MEDLO7041</b>	<b>Machinery Diagnostics</b>	<b>03</b>

**Objectives :**

1. To study basic concepts of Vibration Monitoring.
2. To study different Vibration Measuring Instruments.
3. To study fault detection in Machines using vibration spectrum.

**Outcomes:** Learner will be able to...

1. Relate basic concepts of Machinery Diagnostic.
2. Describe the working of Vibration Measuring Instruments.
3. Apply different Signal Processing Techniques in Vibration Measurement.
4. Identify common faults in Machinery using Vibration Spectrum.
5. Interpret the Vibration Signals for Monitoring and Prognosis.

Module	Contents	Hours
1	<p><b>1.1 Basics of Vibration</b> Periodic and random motion, Spectral Amplitude Scaling: RMS, Peak and Peak-to-Peak Conversion and Selection, Time and frequency domain analysis, Phase analysis, Orbit analysis, Understanding signal pattern, Importance of speed in accurate diagnosis, Importance of side bands in frequency spectrums.</p> <p><b>1.2 Introduction to Vibration based Condition Monitoring</b> Maintenance Principles, Vibration based fault Prognosis, Goal of Vibration Monitoring, Steps in Vibration Monitoring, Benefits of Vibration based condition monitoring.</p>	07
2	<p><b>Vibration Measurement</b></p> <p>Vibration measuring instruments: displacement, velocity, acceleration; Force measurement, Laser based measurements: laser vibrometer</p> <p>Sensor Selection Criteria , Sensor – Mounting Locations and Techniques</p>	07
3	<p><b>Data Acquisition &amp; Signal Processing</b></p> <p>Classification of signals, Signal analysis, Fast Fourier Transform (FFT), Essential Settings in Data Acquisition System (Plot Formats, Frequency Span and Frequency Resolution, Average Types and Number of Averages, Windowing, Spectrum Scaling), Signal conditioning</p>	07
4	<p><b>Machinery Fault Diagnosis I</b></p> <p>Natural frequency and resonance tests (Practical approach), Time and Frequency domain analysis to identify unbalance, bent shaft, Misalignment, Soft foot conditions, Mechanical looseness</p>	06

<b>5</b>	<b>Machinery Fault Diagnosis II</b> Rolling element bearing and Journal Bearing fault diagnosis, Faults related to Gearbox, vane defects in pumps, Fault in Fans and Blowers.	<b>06</b>
<b>6</b>	<b>Applications of Condition Monitoring</b> Case studies related Balancing Problems in Turbines, Condition Monitoring in Sugar mills, Health Monitoring of Journal Bearing, Condition Monitoring of Industrial Pumps. (Aspects to be covered : Selection of sensors, recommended location of sensor, direction of measurement, selection of plot type, Data validation and Identification of Faults)	<b>06</b>

### Assessment:

#### Internal Assessment for 20 marks:

Consisting **Two Compulsory Class Tests**

First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I)

#### End Semester Examination:

Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of total **six questions, each carrying 20 marks.**
2. **Question 1** will be **compulsory** and should **cover maximum contents of the curriculum.**
3. **Remaining questions will be mixed in nature** (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only **Four questions need to be solved.**

#### Text/Reference Books:

1. R.B. Randall, “Vibration-based Condition Monitoring”, Wiley 2021, ISBN: 978-1-119-47755-6
2. A.R. Mohanty, “Machine Condition Monitoring: Principles and Practices”, CRC Press 2017, ISBN: [9781138748255](https://doi.org/10.1002/9781138748255)
3. R.A. Collacott, “Mechanical Fault Diagnosis and Condition Monitoring”, 1<sup>st</sup> Edition, Chapman and Hall, ISBN: 978-94-009-5723-7
4. J.S. Rao, “Vibratory Condition Monitoring of Machine”, Narosa Publishing House.

#### Links for online NPTEL/SWAYAM courses:

<https://nptel.ac.in/courses/112105232> – Machinery Fault Diagnosis and Signal Processing, IIT, Kharagpur