

CONDITION MONITORING AND SIGNAL PROCESSING

Course Code	20ME4703A	Year	IV	Semester	I
Course Category	Professional Elective-V	Branch	ME	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	Nil
Continuous Internal Evaluation	30	Semester End Evaluation	70	Total Marks	100

Course outcomes: At the end of the course, the student will be able to

	Statement	Skill	Level	Units
CO1	Understand the concepts of maintenance, signal analysis, measuring principles, and various monitoring techniques	Understand	L2	1,2,3,4,5
CO2	Discuss the signal analysis and data acquisition	Understand	L2	2
CO3	Categorize various monitoring techniques and measuring principles of instrumentation	Apply	L3	3,4
CO4	Examine machine tool condition monitoring and various case studies	Apply	L3	5

**Contribution of Course outcomes towards achievement of Program outcomes
& Strength of correlations (High:3, Medium: 2, Low:1)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	1	1						2	3	1
CO2	3	2	2	2	1	1						2	3	1
CO3	3	2	2	2	1	1						2	3	1
CO4	3	2	2	2	1	1						2	3	1

Syllabus

UNIT	Course Content	Mapped CO s
I	Basics of Maintenance - Present Status, Fault Prognosis, Future Needs, Principles of Maintenance, Reactive Maintenance, Preventive Maintenance, Predictive Maintenance Fundamentals of Machinery Vibration: Introduction, Forced Vibration Response, Base Excitation, Force Transmissibility, and Vibration Isolation, Unbalanced Response, Characteristics of Vibrating Systems, Experimental Modal Analysis	CO1
II	Signal Analysis: Classification of Signals, Frequency Domain Signal Analysis, Fundamentals of Fast Fourier Transform Data Acquisition and signal Recording: Computer-Aided Data Acquisition, Signal Conditioning, Signal Demodulation, Cepstrum Analysis, Examples	CO1, CO2
III	Measuring principles in condition monitoring - Instrumentation: Static and Dynamic Measurements, Basic Measuring Equipment, Vibration, and Noise Measurement Temperature Measurements, Laser-Based Measurements, Chemical composition Measurements. Vibration Monitoring: Misalignment Detection, Eccentricity Detection, Cracked Shaft, Bowed and Bent Shaft, Unbalanced Shaft, Looseness, Rub, bearings and gears Diagnostic chart.	CO1, CO3

IV	<p>Thermography: introduction, thermal imaging devices, industrial application of thermography, Application of thermography in condition monitoring</p> <p>Wear Debris Analysis: Introduction, Mechanism of wear, Detection of wear particles, oil sampling techniques, oil analysis, and limitations.</p> <p>Electrical Machinery Faults: Introduction, Construction of an Electric Motor, Faults in Electric Motor, Fault Detection in Electric Motors, MCSA for Fault Detection in Electrical Motors</p>	CO1, CO3
V	<p>Machine Tool condition Monitoring: Sensors for tool condition monitoring, indirect tool wear measurement, tool condition monitoring system,</p> <p>Case studies and Failure Analysis, Bend Pulley Failure Analysis, Root Cause Analysis of Torsion Shaft Failure, Failure Analysis of a Conveyor System Support Structure, Vibration Measurements on a Motor-Multistage Gearbox Drive Set</p>	CO1, CO4

Learning Resources

Text Book(s):

1. A. R. Mohanty, Machinery Condition Monitoring: principles and practices, CRC press

References:

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| <ol style="list-style-type: none"> 1. Collacott, R.A., Mechanical Fault Diagnosis and Condition Monitoring, Chapman & Hall, London, 2. John S. Mitchell, Introduction to Machinery Analysis and Monitoring, Penn Well Books, PennWell Publishing Company, Tulsa, Oklahoma, 3. Nakra, B.C. Yadava, G.S. and Thuested, L., Vibration Measurement and Analysis, National Productivity Council, New Delhi, 4. J.O. Den Hartog, Mechanical Vibrations – McGraw Hill, Newyork, 5. Singiresu S. Rao, Mechanical Vibrations, Addison-Wesley Publishing Company 6. An introduction to predictive maintenance, by R Keith Mobley - Butterworth - Heinemann publishing company |
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