GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering
Subject Code: 3720919
CONDITION BASED MONITORING
Semester II

Type of course: Programme Elective

Prerequisite: Zeal to learn the subject

Rationale: To provide comprehensive knowledge of diagnostic maintenance of machinery.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks		Practical Marks				
L	T	P	C	ESE (E)	PA (M)	PA (V)		PA (I)		
						ESE	OEP	PA	RP	
3	0	2	4	70	30	20	10	10	10	150

Content:

Sr. No	Topic	Hours
1	**Introduction** Introduction to Condition Based Maintenance (CBM), Application and economic benefits, Signature analysis – online and off-line techniques	05
2	**Fundamentals of Signal Processing** Basics of signal processing: Study of periodic and random signals, probability distribution, statistical properties, auto and cross correlation and power spectral density functions of commonly found systems, spectral analysis. Fourier transform: the basic idea of Fourier transform, interpretation and application to real signals. Response of linear systems to stationary random signals: FRFs, resonant frequencies, modes of vibration,	08
3	**Various Condition Monitoring (CM) techniques** Vibration monitoring and analysis, Time and Frequency domain analysis, Shock Pulse Method, Thermal monitoring, Noise monitoring, Envelope detection technique, Oil analysis including wear debris and contaminant monitoring, Performance monitoring, Acoustic emission and other techniques, Nondestructive techniques	15
4	**Knowledge-based systems for Condition Monitoring** Instruments used for condition monitoring, Future developments in condition monitoring techniques and systems	05
5	**Practical applications of diagnostic maintenance** Condition monitoring of mechanical and electrical machines, Condition monitoring of Bearings and gears, Electro pneumatic systems	10

Reference Books:

1. Handbook of Condition Monitoring: Techniques and Methodology , A. Davies, Springer.
2. Handbook of Condition Monitoring, B. K. N. Rao, Elsevier.
3. Condition-based Maintenance and Machine Diagnostics, J.H. Williams, A. Davies, P.R. Drake, Springer.
4. M.Adams, Rotating Machinery Analysis - from analysis to troubleshooting, Marcel Dekker, New York, 2001, ISBN 0-8247-0258-1.

5. Cornelius Scheffer, Paresh Girdhar, Practical Machinery Vibration Analysis and Predictive Maintenance**,** 1st Edition, 2004, Paperback ISBN**:** 9780750662758

Course Outcome:

Sr. No.	Course Outcome	Percentage weightage
CO-1	Students will be able to perform practical analysis on actual machines and systems.	20%
CO-2	Students will be able to develop a maintenance strategy based on system response.	20%
CO-3	Students will be able to understand the advantages and limitations of a variety of techniques for condition monitoring.	30%
CO-4	Students will be able to understand the practical aspects of instruments used for condition monitoring.	20%
CO-5	Students will be able to understand the environmental benefits of condition monitoring techniques.	10%

List of Experiments:

Experiments will be based on

1. Fourier transformation and signal processing techniques.
2. Data acquisition and analysis of actual machine signal.
3. Vibration Monitoring of machine component .
4. Oil monitoring of machine component.
5. Non Destructive testing of machine components.
6. Condition monitoring of Electrical machines.

Major Equipment:

- Instruments for data acquisition, sensors and FFT analyzer
- Facility related to oil monitoring
- MATLAB/ High end Simulation software for mechanisms/robots

List of Open source software/learning website: