Introduction to PHM and HUMS: Technologies for Smarter Maintenance and System Readiness

PART 1	
Time	**Topics**
8:30 – 8:50	1. Introduction: 2. Why PHM: Return on Investment and Safety Improvement
8:50 – 9:30 am	**Accelerometer Basics** - Mems vs. PZT - Measurement/Sensor Errors - Bracketry/Mounting
	Sampling - Aliasing vs. LPF and Decimation
	Basics - Acceleration vs. Velocity - RMS vs. Peak to Peak/Basic Statical Operators
9:30 – 10:30am	**Filtering** - Aliasing, Low Pass/Decimation, High Pass - Effect of Phase
	Fourier Transform - Ideal Spectrum - Welches spectrum/Window - Gibb Effect vs. Idealized Filtering - Optimal Frequency/Magnitude Measurement
11:00 – 12 pm	**Shaft Analysis** - TSA - Effect of Jitter, timing error (paper) **Gear Analysis**
12 – 1 pm	**LUNCH**
1:30 – 2:30 pm	**Bearing Analysis** - Cyclo-stationarity - Window selection - Spectral Kurtosis **Rotor Balance**

PART 2	
Time	**Topics**
2:30 – 3:30 pm	**Automated Feature Extraction on Time-Series Data:** - Extracting features in time domain - Extracting features in frequency domain - Feature Ranking: unsupervised, diagnostics and prognostic ranking algorithms
4 – 5 pm	**Building Diagnostic Applications** - Automated Machine Learning (AutoML) - Model selection for Diagnostic applications - Model Trustworthiness - Model Explainability - Incremental Learning
5 – 6 pm	**Building Prognostic Applications** - Designing Health Indicators - Remaining Useful Life (RUL) Estimator Models - RUL model training and update with new data **Deployment in Production Systems** - Automated code generation - Deploy as custom apps - Deploy into cloud servers as microservices/ docker images