Department of Mechanical Engineering
Indian Institute of Technology, Kharagpur

Autumn Semester (2018-19)
Mid-Semester Examination
Subject No. & Name: ME60103- **Machinery Fault Diagnosis & Signal Processing**

No. of Students: 47
Time: 2 Hours

B.Tech- DD, M.Tech, R/S
Full Marks: 30

Instructions:
Answer all the six questions, all questions carry equal marks
Assume, any relevant data if required, with justification

Q.1) Clearly differentiate between the two
(a) Cross spectrum and Auto spectrum
(b) Signal Beating and Signal Modulation
(c) Tuned Absorber and Torsional Damper
(d) Predictive Maintenance and Preventive Maintenance
(e) FFT and DFT

Q.2) Give technical justifications behind the following
(a) Inertia blocks are used for vibration isolation
(b) It is not possible to have a FFT analyzer to analyze televsion signals
(c) As per ISO standard balancing is done for different grades
(d) An impact excitation is used to determine the natural frequency of a system
(e) For experimental modal analysis a two channel signal analyzer is required at the least.

Q.3) List ten desirable specifications parameter of a data acquistion system, and provide a reason behind the two most significant possible errors in data acquisition.

Q.4) A transducer used for vibration measurement has a dynamic range of 80 dB, if the maximum velocity it can measure at 1000 rad/s is 100 mm/s. Determine a suitable gain in the signal conditioner so that the minimum vibration velocity measured by the transducer can be detected by an 8 bit data acquisition system having an input range of 10 V. The dynamic sensitivity of the transducer at 159.2 Hz is 10 mV/m-s^2.

Q.5) Write short notes on the following
(a) FMECA
(b) Analog Filters
(c) Frequency resposne of a transducer
(d) Wireless data acquistion
(e) Picket Fence effect in FFT

Q.6) Q.2. The linear fourier transform of two signals x and y are given as follows. Determine the coherence between the signals at a circular frequency of 1000 rad/s

$$F_x(f) = 2f + i3f, \qquad F_y(f) = -2f + i9f$$

Where f is frequency in Hz.