KUMARAGURU
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Register Number:………..…

M.E DEGREE EXAMINATIONS: NOV/DEC 2023

(Regulation 2018)

First Semester

INDUSTRIAL ENGINEERING

P18IEE0025**:** Condition Monitoring

COURSE OUTCOMES

CO1:   Illustrate the fundamental principles of machinery vibration.

CO2:   Explain signal analysis, fundamentals of FFT and signal conditioning

CO3:   Choose instrumentation for condition monitoring.

CO4:   Explain the vibration and noise based condition monitoring techniques.

CO5:   Describe Machine tool condition monitoring.

Time: Three Hours   **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1.   The system governed by the equation $m\ddot{x} + c\dot{x} + kx = 0$ is dynamically stable if   CO1   [K4]

   a)   k is positive   b)   c and k are negative

   c)   c and k are positive   d)   c is positive

2.   The reduction of the amplitude ratio in the presence of damping is very significant   CO1   [K2]

   a)   Near $\omega = \omega_n$ b) $\omega = 0$

   c) $\omega = \sqrt{\omega_n}$ d)   at $\omega = \omega_n$

3.   By performing ……….. one can capture the frequency where mechanical events   CO2   [K2]
   occur.

   a)   Time domain analysis   b)   ABC analysis

   c)   Frequency domain analysis   d)   SAHA analysis

4.   Match the following for a system with m = 1, k = 1000 N/m & C = 20 N-sec/m   CO2   [K4]

	List I		List II
A.	Natural frequency	i	3.976
B	linear frequency	ii	31.62
C.	critical damping constant	iii	5.03
D.	damping ratio	iv	31.62

a)   A – ii, B - iii, C-iv, D- i   b)   A – iii, B - ii, C-iv, D- i

c)   A – i, B - iii, C-iv, D- ii   d)   A – ii, B - iv, C-iii, D- i

5. An / A _____ is used to provide a high gain to the input signal.   CO3   [K2]

   a)   Operational amplifier   b)   Signal Generators

   c)   Oscilloscope   d)   Signal Filters

6. An optical encoder is used for measuring the _____ to very high accuracy.   CO3   [K2]

   a)   displacement   b)   velocity

   c)   acceleration   d)   rotational speed

7. Assertion (A): To measure sound, logarithmic scale is preferred.   CO4   [K2]
Reason (R): Large variation in amplitude levels

   a)   Both A and R are true, but R is the correct   b)   Both A and R are true, but R is not the correct

   c)   Both A and R are false   d)   A is true but R is false

8. The root means square of the sound pressure is   CO4   [K2]

(where p(t) is the sound pressure at any time)

   a) $p_{rms} = \sqrt{(p^2(t))_t}$ b) $p_{rms} = \sqrt{2p(t)}$

   c) $p_{rms} = p(t)^2/\sqrt{2}$ d) $p_{rms} = \sqrt{p(t)}/2$

9. The detection techniques for the size of the wear debris in the oil is/are   CO5   [K2]
   1. Spectroscopy
   2. Ferrography
   3. Fatigue Wear
The correct answer is

   a)   1 and 2   b)   2

   c)   1   d)   1, 2 and 3

10. Chatter is due to......... in machine tools,   CO5   [K2]

   a)   Free vibrations   b)   Random vibrations

   c)   Forced vibrations   d)   Self-excited vibrations

PART B (10 x 2 = 20 Marks)

11. Illustrate the response equation for harmonic oscillator to a harmonic force.   CO1   [K2]

12. Define the magnification factor and write the expression.   CO1   [K2]

13. What is meant by Signal Conditioning?   CO2   [K2]

14. Infer the term Coherence Function in machinery condition monitoring.   CO2   [K2]

15. What is the dynamic range of an instrument?   CO3   [K2]

16. List down the factors for increasing the demand of condition monitoring in textile industry.   CO3   [K2]

17. Is it possible to use to IOT for condition monitoring? Justify   CO4   [K5]

18.	Compare near-field condition with far-field condition	CO4	[K3]
19.	List the sensors or condition monitoring.	CO5	[K2]
20.	What is the use of optical sensor in machine tool condition monitoring?	CO6	[K2]

PART C (6 x 5 = 30 Marks)

21.	Explain the characteristics of vibrating systems.	CO1	[K2]
22.	Discuss the fundamentals of Fast Fourier Transform.	CO2	[K2]
23.	Discuss the single plane balancing using phase and vibration measurements with suitable example.	CO3	[K4]
24.	Discuss in detail the following term with respect to the instrumentation used for vibration, force and rotational speed	CO3	[K2]
25.	Explain the method to detect bent shaft and unbalanced shaft.	CO4	[K4]
26.	Describe the condition monitoring technique to monitor the performance of rotating machine.	CO5	[K4]

Answer any FOUR Questions

PART D (4 x 10 = 40 Marks)

27.	Discuss the causes of transmissibility, isolation, and absorption in vibration and their effects on machinery?	CO1	[K4]
28.	Interpret the following term related to signal analysis with suitable applications	CO2	[K2]
29.	List and describe instruments which are used to study of the signals.	CO3	[K3]
30.	Explain the sound fields in Noise measurements.	CO4	[K4]
31.	Explain tool condition monitoring system to estimate tool wear measurements with suitable example.	CO5	[K2]

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