



**B.E/B.TECH DEGREE EXAMINATIONS: APRIL /MAY 2024**

(Regulation 2018)

Sixth Semester

**MECHATRONICS ENGINEERING**

U18MCE0002: Condition Monitoring

**COURSE OUTCOMES**

- CO1:** Recognize the types of failures and maintenance strategies.  
**CO2:** Illustrate the fundamental principles of machinery vibration.  
**CO3:** Explain signal analysis, fundamentals of FFT and signal conditioning.  
**CO4:** Explain the vibration and noise based condition monitoring techniques.  
**CO5:** Explain the thermography and wear analysis for condition monitoring.  
**CO6:** Identify and explain the appropriate condition monitoring technique for a given application.

**Time: Three Hours**

**Maximum Marks: 100**

**Answer all the Questions:-**

**PART A (10 x 2 = 20 Marks)**

**(Answer not more than 40 words)**

- |   |     |                   |
|---|-----|-------------------|
| 1. List the types of maintenance strategies.  | CO1 | [K <sub>2</sub> ] |
| 2. Illustrate bathtub curve and mention the various stages.   | CO1 | [K <sub>2</sub> ] |
| 3. Illustrate the response curves for underdamped, critically damped and over damped systems.   | CO2 | [K <sub>2</sub> ] |
| 4. There are certain systems such as flexible bodies are used in robotics. How many degrees of freedom such continuous bodies have and justify. | CO2 | [K <sub>3</sub> ] |
| 5. Distinguish deterministic and non-deterministic signals  | CO3 | [K <sub>2</sub> ] |
| 6. State the sound pressure level.  | CO4 | [K <sub>2</sub> ] |
| 7. State how the looseness is identified using vibration signature  | CO4 | [K <sub>3</sub> ] |
| 8. List the various oil analysis techniques.  | CO5 | [K <sub>2</sub> ] |
| 9. List the detection capabilities of thermal imaging camera.   | CO6 | [K <sub>3</sub> ] |
| 10. State the significance of FFT in condition monitoring.  | CO6 | [K <sub>3</sub> ] |

**Answer any FIVE Questions:-**  
**PART B (5 x 16 = 80 Marks)**  
**(Answer not more than 400 words)**

- |     |    |   |   |     |                   |
|-----|----|---|---|-----|-------------------|
| 11. | a) | Explain various maintenance strategies used   | 8 | CO1 | [K <sub>2</sub> ] |
|     | b) | State the significance of FMECA and explain the main steps followed in FMECA with one model FMECA worksheet.                | 8 | CO1 | [K <sub>2</sub> ] |
| 12. | a) | Explain the various damping responses and how the passive and active dampers used to control the vibration transmissibility | 8 | CO2 | [K <sub>2</sub> ] |
|     | b) | Explain the continuous system and how it is mathematically established.   | 8 | CO2 | [K <sub>2</sub> ] |
| 13. | a) | With neat sketch, explain the process of implementing compressor condition monitoring                                       | 8 | CO3 | [K <sub>2</sub> ] |
|     | b) | Explain various signal processing methods used in condition monitoring  | 8 | CO3 | [K <sub>2</sub> ] |
| 14. | a) | Explain how misalignment and eccentricity is detected.  | 8 | CO4 | [K <sub>3</sub> ] |
|     | b) | Explain the process of cracked and bent shaft are identified using vibration signature.                                     | 8 | CO4 | [K <sub>3</sub> ] |
| 15. | a) | Describe the process of calculating the residual life of machinery.   | 8 | CO5 | [K <sub>2</sub> ] |
|     | b) | Explain how thermography is used in condition monitoring with one example.  | 8 | CO5 | [K <sub>2</sub> ] |
| 16. | a) | Explain following acoustic terminologies: Sound pressure, sound intensity and noise fields.                                 | 8 | CO6 | [K <sub>3</sub> ] |
|     | b) | Describe various oil analysis techniques and list the selection criteria used to identify the technique.                    | 8 | CO6 | [K <sub>3</sub> ] |

\*\*\*\*\*