



SYLLABUS: B Tech (ME)
Department: Mechanical Engineering – 8th Semester

Subject: Mechanical Vibration (Theory)

Subject Code: AE 404 B

Detailed Content

UNIT NO.1 Basic Concept & Single Degree Of Freedom System- Undamped And Damped

- Topic No.1: Classifications of Vibrations Free and Forced
- Topic No.2: Undamped and Damped, Linear and Non-linear, Deterministic and Random, Harmonic Motion
- Topic No.3: Vector and Complex Number Representations, Single Degree of Freedom system
- Topic No.4: Governing equations using D'Alemberts Principal, Concept of viscous damping
- Topic No.5: Response of Free Damped Vibrations (Under Damping, Critical and Over Damping)
- Topic No.6: Logarithmic Decrement, Determination of Structural damping
- Topic No.7: Determination of natural frequency of vibratory systems using Energy Method,, Equivalent systems

UNIT NO.2 Forced Vibrations

- Topic No.8: Governing equation under harmonic excitation
- Topic No.9: Response using techniques of calculus , Phasor diagram
- Topic No.10: Magnification factor. Active and passive vibration isolation
- Topic No.11: Forced and Motion Transmissibility, Rotating and Reciprocating unbalance
- Topic No.12: Critical Speeds and Whirling of Rotating Shafts Vibration isolation materials
- Topic No.13: Transient Response. Impulse Excitation, Response to Step Excitations

UNIT NO.3 Multi Degree Freedom System And Numerical Techniques

- Topic No.14: Two Degrees of Freedom System, Normal Mode Vibrations
- Topic No.15: Coordinate Coupling, Principal Coordinates
- Topic No.16: Free Vibrations in Terms of Initial Conditions
- Topic No.17: Forced Harmonic Vibrations, Simple Vibration Absorber
- Topic No.18: Multi degrees of Freedom Systems
- Topic No.19: Eigen value problems, Close coupled system
- Topic No.20: Far coupled systems using influence coefficient
- Topic No.21: Natural Frequencies , Normal Modes, Orthogonality of Normal Modes, Method of Matrix Iteration
- Topic No.22: Introduction to vibration of continuous system with help of lateral vibration of Beam
- Topic No.23: Dunkerley's method. Rayleigh's method

UNIT NO.4 Vibration Measurement And Condition Monitoring

- Topic No.24: Principle of seismometer, Accelerometer, Basic Vibration measuring set ups
- Topic No.25: Amplitude and phase measurement, Vibration pick-ups
- Topic No.26: Working principle of piezoelectric accelerometer
- Topic No.27: Eddy current based displacement probe
- Topic No.28: Bending critical speed of simple shaft
- Topic No.29: Fourier series and Fourier transform
- Topic No.30: Condition monitoring- its need and types
- Topic No.31: Concept of 1X, 2X,3X, Vibration signals in a rotating machines

Study Scheme				Evaluation Scheme			Total Marks
Lectures per week				Internal Assessment	External Assessment (Examination)		
L	T	P	Credits	Max. Marks	Max. Marks	Exam Duration	
3	1	-	4	25	75	3 hours	100

Reference Books:

1. Theory of Vibrations with Applications W.T. Thomson, Prentice Hall of India.
2. Mechanical Vibration : G.K. Grover and S.P. Nigam, Nem Chand and Sons
3. Mechanical Vibrations: Thammaiah Gowda, Mc-Graw Hill
4. Theory and Practice of Mechanical Vibrations J.S. Rao and K. Gupta, Wiley Eastern Ltd.
5. Mechanical Vibrations S.S. Rao, Addison – Wesley Publishing Company