22MEHO210	MECHANICAL VIBRATIONS				
PREREQUISITES	**CATEGORY**	**L**	**T**	**P**	**C**
	PE	**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

1.	To understand the Fundamentals of Vibration and its practical applications.
2.	To understand the characteristics of free and forced vibration.
3.	To understand the Single and Multi DOF of vibration system.
4.	To understand the working principle and operations of various vibration measuring instruments
5	To understand about the vibration analysis methods.

UNIT I	**FUNDAMENTALS OF VIBRATIONS**	**9**	**0**	**0**	**9**

Basic concepts of vibration – causes and effects of vibrations – vibration parameters – spring, mass, damper models. Motion – periodic, non-periodic, harmonic, non-harmonic. Degree of freedom, static equilibrium position, vibration classification – steps involved in vibration analysis.

UNIT II	**FREE VIBRATION OF SINGLE DEGREE OF FREEDOM SYSTEMS**	**9**	**0**	**0**	**9**

Free undamped single DOF vibration system – Longitudinal, transverse, torsional vibration system – Methods for formulation of differential equations by newton, energy, lagrangian and Rayleigh's method. Viscous damped system – under damped, critically damped, over damped – logarithmic decrement – Coulomb's damping; combined viscous and coulomb's damping.

UNIT III	**FORCED VIBRATION OF SINGLE DEGREE OF FREEDOM SYSTEMS**	**9**	**0**	**0**	**9**

Forced Single DOF system – Analysis of linear and torsional systems subjected to harmonic force excitation and harmonic motion excitation (excluding elastic damper) – vibration isolation – force transmissibility – motion transmissibility, typical isolators & mounts – Rotor dynamics, critical speed of single rotor, undamped and damped.

UNIT IV	**VIBRATION OF MULTI DEGREE OF FREEDOM SYSTEMS**	**9**	**0**	**0**	**9**

Free undamped Multi Degree of Freedom vibration system – Influence Coefficients and stiffness coefficients- Flexibility Matrix and Stiffness Matrix - Eigen values and Eigen vectors for linear system and torsional two degree of freedom ; Holzer method for linear and torsional unbalanced system; Two rotors, three rotors and geared system; Dunkerley's and Rayleigh's method for transverse vibratory system.

UNIT V	**VIBRATION MEASURING INSTRUMENTS AND VIBRATION ANALYSIS**	**9**	**0**	**0**	**9**

Vibration Analysis Overview - Experimental Methods in Vibration Analysis.-Vibration Measuring Instruments - Selection of Sensors- Accelerometer Mountings. -Vibration Exciters-Mechanical, Hydraulic, Electromagnetic And Electrodynamics – Frequency Measuring Instruments-. System Identification from Frequency Response -Testing for resonance and mode shapes.

TOTAL(45L) : 45 PERIODS

TEXT BOOKS:

1.	Mechanical Vibration by V.P.Singh
2.	Singiresu S. Rao, "Mechanical Vibrations", Pearson Education Incorporated, 2017.

REFERENCES:

1.	Benson H. Tongue, "Principles of Vibrations", Oxford University, 2007.
2.	Grover. G.K., edited by Nigam. S. P., "Mechanical Vibrations", Nem Chand and Bros., 2014.
3.	David A. Bies and Colin H. Hansen, "Engineering Noise Control – Theory and Practice", Spon Press, 2009.

4.	Julian Happian-Smith – "An Introduction to Modern Vehicle Design", Butterworth-Heinemann, 2001.
5.	William T. Thomson, "Theory of Vibration with Applications", Taylor and Francis, 2003.
6.	Balakumar Balachandran and Edward B. Magrab, "Fundamentals of Vibrations", 1st Editon, Cengage Learning, 2009
7.	Grover. G.T., "Mechanical Vibrations", Nem Chand and Bros., 2009
8.	NPTEL :: Mechanical Engineering - NOC: Introduction to Mechanical Vibration

COURSE OUTCOMES: Upon completion of this course, the students will be able to:		**Bloom Taxonomy Mapped**
CO1	Determine stresses in pressure vessels	Evaluate
CO2	Design pressure vessels using ASME codes	Create
CO3	Design support members of pressure vessels	Create
CO4	Apply other design considerations for pressure vessels	Apply
CO5	Design of pressurized fluid piping	Create

COURSE ARTICULATION MATRIX

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1	2	2	1	0	0	0	0	0	0	0	0	2	2	0
CO2	3	3	2	2	0	0	0	0	0	0	0	0	2	2	0
CO3	3	3	2	2	0	0	0	0	0	0	0	0	2	2	0
CO4	3	3	2	2	0	0	0	0	0	0	0	0	2	2	0
CO5	1	1	2	2	0	0	0	0	0	0	0	0	2	2	0
Avg	**2.2**	**2.4**	**2**	**1.8**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**2**	**2**	**0.0**

3/2/1 – indicates strength of correlation (3 – high, 2- medium, 1- low)