AMITY UNIVERSITY
UTTAR PRADESH

Course Title: THEORY OF VIBRATIONS **Credit Units: 04**

L	T	P/S	SW/ FW	TOTAL CREDIT UNITS
2	1	2	-	4

Course Code: To be decided

Course Level: UG

Course Objectives

This course is designed to provide adequate knowledge to analyse one-degree and multi-degree of freedom systems of vibrations using different methods to find out their natural frequencies and frequency / amplitude responses.

Pre-requisites: Mechanics of Solids

Course Contents/Syllabus:

	Weightage (%)
Module I : Fundamental of Vibrations	**10**
Descriptors/Topics*:* Importance of study of vibrations, classifications of vibrations, Harmonic motion, definition and terminology, harmonic analysis, work done by a harmonic force on a harmonic motion **.** Vibration damping & cancellation methods.	
Module II : Un-damped Free Vibration of Single Degree of Freedom System	**15**
Descriptors/Topics : Introduction, derivation of differential equation, solution of differential equation, method based on Newton's second law of motion, Energy method and Rayleigh's method. Determination of Equivalent spring stiffness, D'Alembert's principle.	
Module III : Damped Free Vibration of Single Degree of Freedom system	**15**
Descriptors/Topics : Introduction, different types of damping, Differential equation of damped free vibration, Logarithmic decrement, different types of dampers.	
Module IV : Forced Vibration of Single Degree of Freedom System:	**20**

Descriptors/Topics Introduction, equation of motion for forced damped /undamped vibrationwith constant harmonic excitation, Vibration isolation and transmissibility. Effect of frequency ratio on magnication factor and transmissibility ratio. Whirling of shaft with damping/without damping having single disc, critical speed.	
Module V : Two degree of freedom system	**20**
Descriptors/Topics Introduction, equation of motion and natural frequencies, principal modes of vibration, vibrations of Undamped/ Damped free vibration of two degree of freedom. Forced vibration in two degree of freedom system. Forced harmonic vibration in two degree of freedom system. Torsional system in two degree of freedom.	
Module VI :Three degree of freedom system	
Descriptors/Topics : Introduction, free vibration-equation of motion, Influence coefficients, Generalized coordinates and coordinate coupling, natural frequencies and mode shapes, Numerical methods for finding natural frequencies: method of matrix iteration , Rayleigh method, Dunkerley's method, Stodola's method.	**20**

Student Learning Outcomes:

- Develop mathematical model of vibrating mechanical systems.
- Determine natural frequencies, amplitude, nodes and anti-nodes of vibrating system.
- Apply theoretical knowledge of vibration theory to solve practical problems of real world.
- Examine the problem of structure for modes shapes of vibration
- Evaluate the response of the vibrating system and its effect

Pedagogy for Course Delivery: Session Plan / course-material uploading, Class-room teaching associated with assignments, Lab measurements & report writing, presentations**,** quiz, viva-voce and evaluation.

Lab/ Practicals details, if applicable:

List of Experiments:

- To determine natural frequency of longitudinal vibration of a spring under tensile load.
- To determine natural frequency of longitudinal vibration of springs, Two in parallel and one spring in series under tensile load.
- To determine natural frequency of transverse vibrations of a cantilever subjected to transverse vibration.
- To determine the natural frequency of axial vibrations of a bar suspended by two cords.
- To determine the natural frequency of torsional vibrations of a bar suspended by two cords.

- To determine the natural frequency of torsional vibrations of a ring suspended by three cords and to determine mass moment of inertia of a bar of rectangular sections.
- To determine the logarithmic decrement of torsional vibrations of a shaft subjected to air damping.
- To determine experimentally the whirling speed of shaft for a given system.
- To determine the damping coefficient of kerosene oil as damping medium for a spring with axial vibrations.

Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical/Studio (%)	Total
75	25	100

Theory Assessment (L&T):

Continuous Assessment/Internal Assessment - 30					End Term Examination
Components (Drop down)	**A**	**CT**	**S/V/Q**	**HA**	**70**
Weightage (%)	5	10	8	7	70

Lab/ Practical/ Studio Assessment:

	Continuous Assessment/Internal Assessment				End Term Examination	
Components (Drop down	**PR**	**LR**	**V**	**A**	**EXP**	**V**
Weightage (%)	10	10	5	5	35	35

Text & References:

- Francis S. Tse., Ivan E. Morse, “Mechanical Vibrations”, Rolland T. Hinkle, Prentice Hall of India
- Austin H. Church, “Mechanical Vibrations”, John Wiley and Sons, Reprint 1991
- S. Timoshenko, “Vibration Problems in Engineering”, Van Nostrand.
- K.K. Pujara, “Vibration for Engineers”, Dhanpat Rai and Sons.

Any other Study Material: