



A) COURSE

Course Id:	Course
5648	Mechanical Vibrations

Class Hours per Week	Lab hours per week	Complementary practices	Credits	Total hour course
5	0	5	10	80 hrs theory 80hrs complementary Total hrs.160.

B) GENERAL COURSE INFORMATION:

	EE (IEA)	ME (IM)	MME (IMA)	EME (IME)	MTE (IMT)
Level:		IV			
Course Type (Required/Elective)		Required			
Prerequisite Course:		Calculus D KINEMATICS OF MACHINES			
CACEI Classification:		IA			

C) COURSE OBJECTIVE

At the end of the course, the student will be capable of:
THE STUDENT WILL BE ABLE TO RECOGNIZE AND IDENTIFY THE DIFERENT VIBRATION SYSTEMS TO ESTABLISH THEM AS A FUNCTION OF THE MACHINE OR MECHANICAL DEVICE. ALSO THE STUDENT WILL BE ABLE TO IDENTIFY CRITICAL OPERATION SITUATIONS OF A MECHANICAL EQUIPMENT OR MACHINE.

D) TOPICS (CONTENTS AND METHODOLOGY)

1. Introduction	Hours
Specific Objective:	OBJECTIVE: THE STUDENT WILL UNDERSTAND THE FUNDAMENTALS OF VIBRATIONAL SYSTEMS OF ONE DEGREE OF FREEDOM
1.1 FREE VIBRATION WITHOUT DAMPING WITH DAMPING WITHOUT DAMPING 1.5 CRITICAL FEQUENCY AND VIBRATIONS OF SHAFTS UNDER BENDING LOADS.	1.2 FREE VIBRATION 1.3 FORCED VIBRATION 1.4 FORCED VIBRATION WITH DAMPING
Readings and other resources	Articles, books, Internet, complementary bibliography.
Teaching Methodologies	EXPOSURE OF SUBJECTS OF STUDY OF DIAGRAMS, EXPLANATION OF CONCEPTS, MANAGEMENT OF LABORATORY, PROBLEM-SOLVING TECHNIQUES. VISITS TO COMPANIES AND RESEARCH WORK



Learning Activities	Dynamics of working in team, assignments, and discussion of these. Studies of reproducibility and repeatability, estimation error, uncertainty, calibration. Analysis of readings and presentations in Powerpoint.
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2. MULTIPLE DEGREES OF FREEDOM VIBRATION SYSTEMS		Hours
Specific Objective:	OBJECTIVE: THE STUDENT WILL UNDERSTAND AND DEVELOP THE ABILITY TO ANALYZE AND SOLVE VIBRATION SYSTEMS WITH MULTIPLE DEGREES OF FREEDOM.	
	2.1 FREE VIBRATION WITH MULTIPLE DEGREES OF FREEDOM VIBRATIONS WITH MULTIPLE DEGREES OF FREEDOM NON-DAMPING SYSTEMS VIBRATIONS IN THE CONTINUUM ROD TORSIONAL VIBRATIONS OF RODS STRING VIBRATIONS MEMBRANE VIBRATIONS VIBRATIONS OF PLATES UNDER BENDING	2.2 FORCED 2.3 MODAL ANALYSIS OF VIBRATIONS AXIAL VIBRATIONS OF RODS
Readings and other resources	Articles, books, Internet, complementary bibliography.	
Teaching Methodologies	EXPOSURE OF SUBJECTS OF STUDY OF DIAGRAMS, EXPLANATION OF CONCEPTS, MANAGEMENT OF LABORATORY, PROBLEM-SOLVING TECHNIQUES. VISITS TO COMPANIES AND RESEARCH WORK	
Learning Activities	Dynamics of working in team, assignments, and discussion of these. Studies of reproducibility and repeatability, estimation error, uncertainty, calibration. Analysis of readings and presentations in Powerpoint.	

3. NON LINEAR VIBRATIONS		Hours
Specific Objective:	OBJECTIVE: THE STUDENT WILL UNDERSTAND AND DEVELOP THE ABILITY TO ANALYZE AND SOLVE CASES OF NON LINEAR VIBRATION SYSTEMS.	
	3.1 OSCILLATORS WITH RESTITUTION FORCE OR NON LINEAR SPRING INDEX. FREE OSCILLATION WITHOUT DAMPING FORCED OSCILLATION COEFFICIENTS (RHEOLINEAR)	3.2 OSCILLATIONS WITH PERIODICAL
Readings and other resources	Articles, books, Internet, complementary bibliography.	
Teaching Methodologies	EXPOSURE OF SUBJECTS OF STUDY OF DIAGRAMS, EXPLANATION OF CONCEPTS, MANAGEMENT OF LABORATORY, PROBLEM-SOLVING TECHNIQUES. VISITS TO COMPANIES AND RESEARCH WORK	
Learning Activities	Dynamics of working in team, assignments, and discussion of these. Studies of reproducibility and repeatability, estimation error, uncertainty, calibration. Analysis of readings and presentations in Powerpoint.	

4. Systems with two or more degrees of freedom		Hours
Specific Objective:		
	4.1 Equations of motion of two-degree-of-freedom systems 4.2 Free vibration of undamped systems 4.3 Natural modes of vibration 4.4 Response to initial excitations 4.5 Beat phenomenon 4.6 Response of two-degree-of-freedom systems to harmonic excitations 4.7 Undamped vibration absorbers	
Readings and other resources	Articles, books, Internet, complementary bibliography.	
Teaching Methodologies	EXPOSURE OF SUBJECTS OF STUDY OF DIAGRAMS, EXPLANATION OF CONCEPTS, MANAGEMENT OF LABORATORY, PROBLEM-SOLVING TECHNIQUES. VISITS TO COMPANIES AND RESEARCH WORK	



Learning Activities	Dynamics of working in team, assignments, and discussion of these. Studies of reproducibility and repeatability, estimation error, uncertainty, calibration. Analysis of readings and presentations in Powerpoint.
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5. Distributed-parameter systems		Hours
Specific Objective:		
	5.1 Vibration of strings 5.2 Bending vibration of beams 5.3 Torsional vibration of shafts 5.4 Membrane vibration	
Readings and other resources	Articles, books, Internet, complementary bibliography.	
Teaching Methodologies	EXPOSURE OF SUBJECTS OF STUDY OF DIAGRAMS, EXPLANATION OF CONCEPTS, MANAGEMENT OF LABORATORY, PROBLEM-SOLVING TECHNIQUES. VISITS TO COMPANIES AND RESEARCH WORK	
Learning Activities	Dynamics of working in team, assignments, and discussion of these. Studies of reproducibility and repeatability, estimation error, uncertainty, calibration. Analysis of readings and presentations in Powerpoint.	

E) TEACHING AND LEARNING METHODOLOGIES

F) EVALUATION CRITERIA:

Evaluation:	Schedule	Suggested Form of Evaluation and weighing	Topics
1er. Partial Evaluation	Session	Exam, Assignment, Presence	
2º Partial Evaluation	Session	Exam, Assignment, Presence	
3er. Partial Evaluation	Session	Exam, Assignment, Presence	
Final Evaluation Ordinary		100% (average partial evaluations)	
Other Activity:			
Special Exam:	Week 17 of the Semester	100% Exam	100% topics
Special Exam	According to schedule school secretary	100% Exam	100% topics
Regularization Exam	According to schedule school secretary	100% Exam	100% topics

G) BIBLIOGRAPHY AND ELECTRONIC RESOURCES

Main Books

SINGIRESU S. RAO, MECHANICAL VIBRATIONS, THIRD EDITION, ADDISON WESLEY PUBLISHING COMPANY, 1995



ANDREW DIMARAGONAS, VIBRATIONS FOR ENGINEERS, SECOND EDITION, PRENTICE HALL, 1996.

WILLIAM T. THOMSON AND MARIE D. DAHLEH, THEORY OF VIBRATION WITH APPLICATIONS, 5TH EDN., PRENTICE HALL

DUBBEL, HANDBOOK OF MECHANICAL ENGINEERING, EDITED BY W. BEITZ AND K.-H. KÜTTNER. ENGLISH EDITION EDITED BY M.J. SHIELDS. SPRINGER VERLAG LONDON LIMITED 1994.

Complementary Books

ROCA VILA, R. MECHANICAL VIBRATIONS (VIBRACIONES MECÁNICAS). ED. LIMUSA 1981

HIBBELER R.C., MECHANICAL ENGINEERING: DYNAMICS (INGENIERÍA MECÁNICA: DINÁMICA), PRENTICE HALL, 1996

SÖCHTING, F. BERECHNUNGSMECHANISCHER SCHWINGUNGEN. WIEN: SPRINGER 1959.

MAGNUS, K. SCHWINGUNGEN, 2. AUFL. STTURGART: TEUBNER 1969.

ZIEGLER, G.: MASCHINENDYNAMIK. MÜNCHEN: HANSER 1977

Internet Links