Course Specifications

Course Title:	**Mechanical Vibration**
Course Code:	**ME 242**
Program:	**B.Sc. Mechanical and Industrial Engineering**
Department:	**Mechanical and Industrial Engineering**
College:	**Engineering**
Institution:	**Majmaah University**

Table of Contents

A. Course Identification **3**

6. Mode of Instruction (mark all that apply) 3

B. Course Objectives and Learning Outcomes **4**

1. Course Description 4

2. Course Main Objective 4

3. Course Learning Outcomes 4

C. Course Content **5**

D. Teaching and Assessment **6**

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods 6

2. Assessment Tasks for Students 9

E. Student Academic Counseling and Support **9**

F. Learning Resources and Facilities **9**

1.Learning Resources 9

2. Facilities Required 9

G. Course Quality Evaluation **10**

H. Specification Approval Data **10**

A. Course Identification

1. Credit hours:	3(3,1,0)
2. Course type	
a.	University [x] College [x] Department [√] Others [x]
b.	Required [√] Elective [x]
3. Level/year at which this course is offered:	Level 6th / 6th 1440-1441H (2019-2020) First Semester
4. Pre-requisites for this course (if any)**:**	ME 243
5. Co-requisites for this course (if any)**:**	NA

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	60	80
2	**Blended**	05	10
3	**E-learning**	05	10
4	**Correspondence**	0	--
5	**Other**	0	--

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture**	45
2	**Laboratory/Studio**	0
3	**Tutorial**	15
4	**Others** (specify)	0
	Total	60
Other Learning Hours*		
1	**Study**	20
2	**Assignments**	20
3	**Library**	-
4	**Projects/Research Essays/Theses**	-
5	**Others** (specify)	-
	Total	40

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

Free and damped vibration of single degree of freedom systems. Viscous damping. Forced vibration. Resonance. Harmonic excitation. Rotating unbalance. Base motion. Vibration isolation. Fourier analysis. Vibration measuring. General excitation. Step and impulse response. Two degree of freedom systems. Frequencies and mode shapes. Modal analysis. Un-damped vibration absorber. Multi-degree of freedom systems. Matrix methods. Raleigh and Raleigh-Ritz methods. Continuous systems, axial, torsional and bending vibrations. Finite element method. Applications with computer programs.

2. Course Main Objective

- To introduce the basic concepts and train the students to analyze vibration problems in mechanical engineering
- Analyzing free and force (harmonic) vibration for single and multi-degree of freedom systems
- Analyzing vibration response of a single degree of freedom system under general forcing condition
- Deriving equations of motions for a free and force damped and un-damped vibration systems using either Newton's 2nd law.
- Become proficient in the modeling and analysis of one-DOF-systems - free vibrations, transient and steady-state forced vibrations, viscous and hysteric damping.
- Become proficient in the modeling and analysis of multi-DOF systems.
- Ability to acquire and apply fundamental principles of science and engineering
- Capability to communicate effectively
- Acquisition of technical competence in specialized areas of engineering discipline
- Ability to identify, formulate and model problems and find engineering solutions based on a systems approach,
- Ability to be a multi-skilled engineer with good technical knowledge, management, leadership and entrepreneurship skills.

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	**Knowledge:**	
1.1	To introduce the basic concepts and train the students to analyze vibration problems in mechanical engineering	a(d1)
1.2	Analyzing free and force (harmonic) vibration for single and multi-degree of freedom systems	a(d1)
1.3	Analyzing vibration response of a single degree of freedom system under general forcing condition	a(d1)
1.4	Deriving equations of motions for a free and force damped and un-damped vibration systems using either Newton's 2nd law.	a(d1)
1.5	Become proficient in the modeling and analysis of one-DOF-systems - free vibrations, transient and steady-state forced vibrations, viscous and hysteric damping.	a(d1)
1.6	Become proficient in the modeling and analysis of multi-DOF systems.	a(d1)
1.7	Ability to acquire and apply fundamental principles of science and engineering	a(d1)
1.8	Capability to communicate effectively	a(d1)
1.9	Acquisition of technical competence in specialized areas of engineering	a(d1)

CLOs		Aligned PLOs
	discipline	
1.10	Ability to identify, formulate and model problems and find engineering solutions based on a systems approach	a(d1)
1.11	Ability to be a multi-skilled engineer with good technical knowledge, management, leadership and entrepreneurship skills.	a(d1)
2	**Skills :**	
2.1	The study of Mechanical Vibration is an essential part of a comprehensive foundation in the engineering sciences.	k(d3)
2.2	Mechanical Vibration requires the application of calculus, vector algebra, and other elements of mathematical reasoning.	k(d3)
2.3	At the heart of Mechanical Vibration is precisely the ability to identify, formulate, and solve engineering problems.	e(b3)
2.4	Training in Mechanical Vibration, particularly in developing sound problem-solving methodology, will prepare students for graduate school, to conduct research, and otherwise to discover knowledge throughout life.	b(b1)
3	**Competence:**	
3.1	Identify Mechanical Vibration system used in daily life.	e(b3)
3.2	Be familiar with the concepts of Mechanical Vibration and its various aspect	k(d3)
3.3	Be familiar with the analysis of Free Vibration. Harmonic Motion. Viscous Damping. Stiffness. Measurement. Design Considerations.	b(b1)
3.4	Be familiar with the analysis of Harmonic Excitation of Un-damped Systems. Harmonic Excitation of Damped Systems. Base Excitation. Rotating Unbalance.	k(d3)
3.5	Be familiar with the analysis of Impulse Response Function. Response to an Arbitrary Input.	k(d3)
3.6	Be familiar with the analysis of Two-Degree-of-Freedom Model (Un-damped). Eigenvalues and Natural Frequencies. Acceptable Levels of Vibration. Vibration Isolation. Vibration Absorbers. Damping in Vibration Absorption	b(b1)
3.7	Be familiar with the analysis of Raleigh and Raleigh-Ritz methods. Continuous systems, axial, torsional and bending vibrations. Finite element method. Applications with computer programs.	e(b3)
3.8	Solving Mechanical Vibration systems.	

C. Course Content

No	List of Topics	Contact Hours
1	Free and damped vibration of single degree of freedom systems.	8
2	Viscous damping,	4
3	Forced vibration and resonance, harmonic excitation. and rotating unbalance,	12
4	Base motion, and vibration isolation,	4
5	Two degree of freedom systems,	8
6	Frequencies, mode shapes, and modal analysis,	8
7	Multi-degree of freedom systems, and matrix methods,	8
8	Continuous systems, axial, torsional and bending vibrations.	8
Total		60

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	To introduce the basic concepts and train the students to analyze vibration problems in mechanical engineering	Lectures, tutorials and self-learning assignments.	Attendance of lectures and tutorials is a most.
1.2	Analyzing free and force (harmonic) vibration for single and multi-degree of freedom systems	Introductory lecture gives an overview of the content and methods of assessment.	Attendance of lectures and tutorials is a most. There will be no. of quizzes, homeworks, two midterm examination and one final examination. Examinations are comprehensive, including subjects from all assigned readings, lectures, and classroom demonstrations.
1.3	Analyzing vibration response of a single degree of freedom system under general forcing condition	Tutorials review the content of each lecture.	Quizzes and homeworks on completion of each topic to measure knowledge items.
1.4	Deriving equations of motions for a free and force damped and undamped vibration systems using either Newton's 2nd law.	Assignments require use of reference textbook from library and websites from internet. Homework assignments will consist of problem solving cases.	Tools: a. Mid Term Exam 1 to measure Knowledge and understanding, b. Mid Term Exam 2 to measure Knowledge and understanding, c. Final Exam to measure Knowledge and understanding. Quizzes and Homework to measure Knowledge and understanding
1.5	Become proficient in the modeling and analysis of one-DOF-systems - free vibrations, transient and steady-state forced vibrations, viscous and hysteric damping.	Examinations are comprehensive, including subjects from all assigned readings, lecture, and	

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
		classroom demonstrations.	
1.6	Become proficient in the modeling and analysis of multi-DOF systems.		
1.7	Ability to acquire and apply fundamental principles of science and engineering		
1.8	Capability to communicate effectively		
1.9	Acquisition of technical competence in specialized areas of engineering discipline		
1.10	Ability to identify, formulate and model problems and find engineering solutions based on a systems approach		
1.11	Ability to be a multi-skilled engineer with good technical knowledge, management, leadership and entrepreneurship skills.		
2.0	**Skills**		
2.1	The study of Mechanical Vibration is an essential part of a comprehensive foundation in the engineering sciences.	Lectures, tutorials.	Attendance of lectures and tutorials is a most.
2.2	Mechanical Vibration requires the application of calculus, vector algebra, and other elements of mathematical reasoning.		Attendance of lectures and tutorials is a most. There will be no. of quizzes, homeworks, two midterm examination and one final examination. Examinations are comprehensive, including subjects from all assigned readings, lectures, and classroom demonstrations.
2.3	At the heart of Mechanical Vibration is precisely the ability to identify, formulate, and solve engineering problems.		Quizzes and homeworks on completion of each topic to measure knowledge items.
2.4	Training in Mechanical Vibration, particularly in developing sound problem-solving methodology, will prepare students for graduate school, to conduct research, and otherwise to discover knowledge throughout life.		Tools: • Mid Term Exam 1 to measure Knowledge and understanding, • Mid Term Exam 2 to measure

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
			Knowledge and understanding, • Final Exam to measure Knowledge and understanding, Quizzes and Homework to measure Knowledge and understanding
3.0	**Competence**		
3.1	Identify Mechanical Vibration system used in daily life.	Lectures, tutorials and self-learning assignments.	Attendance of lectures and tutorials is a most.
3.2	Be familiar with the concepts of Mechanical Vibration and its various aspect	Introductory lecture gives an overview of the content and methods of assessment.	Attendance of lectures and tutorials is a most.
3.3	Be familiar with the analysis of Free Vibration. Harmonic Motion. Viscous Damping. Stiffness. Measurement. Design Considerations.	Tutorials review the content of each lecture.	There will be no. of quizzes, homeworks, two midterm examination and one final examination.
3.4	Be familiar with the analysis of Harmonic Excitation of Un-damped Systems. Harmonic Excitation of Damped Systems. Base Excitation. Rotating Unbalance.	Assignments require use of reference textbook from library and websites from internet.	Examinations are comprehensive, including subjects from all assigned readings, lectures, and classroom demonstrations.
3.5	Be familiar with the analysis of Impulse Response Function. Response to an Arbitrary Input.	Homework assignments will consist of problem solving cases.	Quizzes and homeworks on completion of each topic to measure knowledge items.
3.6	Be familiar with the analysis of Two-Degree-of-Freedom Model (Un-damped). Eigenvalues and Natural Frequencies. Acceptable Levels of Vibration. Vibration Isolation. Vibration Absorbers. Damping in Vibration Absorption	Examinations are comprehensive, including subjects from all assigned readings, lecture, and classroom demonstrations.	Tools are Mid Term Exam 1 to measure Knowledge and understanding, Mid Term Exam 2 to measure Knowledge and understanding,
3.7	Be familiar with the analysis of Raleigh and Raleigh-Ritz methods. Continuous systems, axial, torsional and bending vibrations. Finite element method. Applications with computer programs.		Final Exam to measure Knowledge and understanding and Quizzes and Homework to measure Knowledge

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
			and understanding.
3.8	Solving Mechanical Vibration systems.		

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	First Major Exam	6th week	20 %
2	Second Major Exam	12th week	20 %
3	Final Exam	Final exam week	40 %
4	Quiz	Continuous	10 %
5	Homework assignments	Continuous	10 %

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

Sun. 08.00:09.50,
Mon. 08.00:08.50,
Mon. 09.00:09.50

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	Engineering Vibration 3 edition, 2008 m Author: Daniel J. Inman, Virginia Polytechnic Institute and State University
Essential References Materials	• Mechanical Vibrations, 5/E, Prentice Hall, 2010 by Singiresu S. Rao, University of Miami. • Journal of Vibration and Control. • http://www.sagepublications.com. • Journal of Vibration and Acoustics (ASME)
Electronic Materials	• Journal of Vibration and Control • http://www.sagepublications.com • Journal of Vibration and Acoustics (ASME) • Sufficiently of Material available on the net.
Other Learning Materials	• Computer-based programs/CD, professional standards or regulations and software. • Handouts

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• Lecture room, • E03 (Sunday), • E04 (Wednesday), • C03 (Tuesday).

Item	Resources
Technology Resources (AV, data show, Smart Board, software, etc.)	• Computer and internet • Data show, • Smart board
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	None

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of Teaching	Students	Indirect Assessment
CLOs achievement	Faculty	Direct/Indirect Assessment
Learning Resources	Students	Indirect Assessment
Course Contents	Students	Indirect Assessment

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	Department Council
Reference No.	1/34/9767
Date	25/02/1441 H