MENG331 – Dynamics of Machinery

Eastern Mediterranean University
Faculty of Engineering

Department: Mechanical Engineering

Program Code: 23	**Program:** Mechanical Engineering	**Year/Semester:** 2019-2020 SPRING

Course Code:	**Course Title:**	**Credit hours**			
		Lec.	**Tut**	**Lab/Activity**	**Total**
MENG331	Dynamics of Machinery	**4**	**1**	**1**	**4**

Type of Course
- ☒ Engineering or Area Core
- ☐ Engineering Course offered by other programs
- ☐ Engineering or Area Elective
- ☐ Mathematics and Basic Sciences
- ☐ General Education

Hourly Contribution
- ☐ Basic Science (-)
- ☐ College-level Mathematics (-)
- ☐ Complex Engineering Problems (-)
- ☐ Engineering Design (-)
- ☒ Engineering Science (3)
- ☒ Team (1)

Criterion 5 Subject Area:
- ☐ (a) College-level mathematics and basic sciences with experimental experience appropriate to the program.
- ☒ (b) Engineering topics appropriate to the program, consisting of engineering and computer sciences and engineering design, and utilizing modern engineering tools.
- ☐ (c) a broad education component that complements the technical content of the curriculum and is consistent with the program educational objectives.
- ☐ (d) a culminating major engineering design experience that
  - ☐ 1) Incorporates appropriate engineering standards and multiple constraints
  - ☐ 2) Based on the knowledge and skills acquired in earlier course work.

Instructor Name: Assoc. Prof. Dr. Qasim Zeeshan	**Office no:** ME141	**Office Tel:** 6301361

Course Web Page: https://staff.emu.edu.tr/qasimzeeshan/en/teaching/meng-331

Textbook(s): Mechanical Vibrations by Singiresu Rao (5th Edition), 2011, Pearson.

Indicative Basic Reading List :
- Design of Machinery by Robert L. Norton (5th Edition), 2012, McGraw Hill.
- Kinematics and Dynamics of Machinery by Robert L. Norton SI Edition, 2008, McGraw Hill.

Catalog Description: Discretized Lumped Parameter Modeling of systems. Free and forced vibrations of single degree-of-freedom systems. Multi degree-of-freedom systems. Determination of natural frequencies and Mode Shapes. Continuous systems. Finite Element Method. Vibration Measurement and Control. Balancing of rotating machinery and reciprocating engines.

Prerequisite(s)	(MENG233 or MENG231) and (MATH207 or MATH241)

Student Outcomes		
1	an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	☒
2	an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	☐
3	an ability to communicate effectively with a range of audiences	☐
4	an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	☐
5	an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	☐
6	an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	☒
7	an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.	☐

Course Learning Outcomes		Student Outcomes							Assessment and Percentages
		1	2	3	4	5	6	7	
1	Model and analyze dynamic systems as discretized lumped parameters	X					X		Quiz 1: 5% Midterm Exam: 30% Quiz 2: 5% Project: 10% Final Exam: 40% Lab Works: 10%
2	Vibration analysis of single DOF systems (damped and undamped)	X					X		
3	Displacement and force transmissibility, and their applications to practical systems	X							
4	Vibration analysis of MDOF systems (damped and undamped)	X							
5	Estimation of the natural frequency of systems.	X							
6	Vibration analysis of Continuous or Distributed Systems	X					X		
7	Mode shapes analysis	X				X	X		
8	Vibration control techniques (elimination, isolation and absorption)	X							
9	Whirling of shafts and balancing of rotating machinery	X					X		
10	Balancing of reciprocating machinery	X							
	Weight of Student Outcomes	**H**				**L**	**M**		

Topics Covered and Class Schedule:	
Week 1	Fundamentals of Vibration
Week 2	Discretized Lumped Parameter Modeling
Week 3	Free Vibration of Single Degree of Freedom Systems
Week 4	Forced vibrations of single degree-of-freedom systems
Week 5	Force and Displacement Transmissibility
Week 6	Two degree-of-freedom systems
Week 7	Multi degree-of-freedom systems
Week 8 & 9	**Midterm Examination**
Week 10	Determination of Natural Frequencies and Mode Shapes
Week 11	Continuous systems
Week 12	Numerical Integration and Finite Element Methods
Week 13	Vibration Measurement and Control
Week 14	Balancing of rotating machinery and reciprocating engines
Week 15	**Final Examination**

Laboratory Experiments				
No.	**Experiment Title and Equipment Used**	**CLO**	**SO**	**Percentage**
1	**Title:** Determination of the stiffness of two different springs **Equipment:** Spring Apparatus – HSM7 and HSM8	**1**	**6**	2.5%
2	**Title:** Damped and undamped vibration response **Equipment:** Universal Vibration Apparatus – TM16	**4**	**6**	2.5%
3	**Title:** Mode shape analysis of cantilever beam **Equipment:** ANSYS software	**6**	**6**	2.5%
4	**Title:** Balancing of Rotating Machines **Equipment:** TM102 – Static and Dynamic Balancing Apparatus	**9**	**6**	2.5%

Important Notes Regarding the Course: University rules and regulations are applied to this course. For details, please see http://mevzuat.emu.edu.tr

Exam and Quiz Policy:

1. Midterm and final exams are open book (only the course textbook is allowed)
2. Quizzes are closed book (students can bring maximum one A4 formula sheet).

Makeups:

1. There is no make-up or resit for the Quiz and Labs.
2. A student who fails to sit for an examination for a valid reason is given a make-up exam. Within three working days after the examination, students who wish to take a make-up must submit a **written statement** to the course instructor explaining the reason(s) for his/her request.
3. Eligibility to take a **Make-Up Exam**:
   a. Student must contact the Instructor immediately within "**three working days**" after the examination when (s)he has missed the mid-term exam or final exam and to discuss with the faculty about the date and time to take the make-up exam.
   b. Student must secure a "**Make-Up Exam Form**" from the department Office or from instructor website & fill-out the Form. For each Make-Up Exam, please use separate Form.
   c. Student must secure the approval from the instructor for taking the Make-Up Exam.
   d. Failure to take the Make-Up Exam at the agreed date and time will lead to a "NG" Grade for the Make-Up Exam, midterm or final.

NG Policy:

1. **"NG" Nil Grade/ Failing from Absenteeism:** Students who do not comply with the required level attendance and/or not fulfilling the requirements for the evaluation of the course are given the "NG" grade by the Instructor of the Course based on the criteria determined by the Faculty/School Academic Council. Students are informed about the criteria for receiving the "NG" grade by the related course instructor at the beginning of the semester. "NG" grade is included in the computation of GPA and CGPA.
2. Student attendance is monitored and assessed by the course instructor. A student who fails to meet the requirements of a course or who is absent more than the limit specified by the Faculty is considered to be unsuccessful in that course.
3. Students who do not attend any of the above assessment activities (such as mid-term exam, final exam, lab exam, design project report etc.) will be given NG (Nil Grade).
4. Late Submissions of the Assignments, Lab Reports and Project will be graded as zero.

Appeals:

Any appeal against the marks of any assessment component must be made to the course instructor within one week following the announcement of the marks. Any appeal concerning a semester grade must be made to the course instructor no later than the end of the registration period of the following semester.