DEPARTMENT OF MECHANICAL AND INDUSTRIAL ENGINEERING
MECHANICAL ENGINEERING PROGRAM, BSC.

Course Syllabus

1. **Course number and name**

ME 335 Dynamics of machinery

2. **Credits and contact hours**

(3+0) 3 credit hours, 3 contact hours

3. **Course type**

Blended Learning Course (2+1)

4. **Instructor's or course coordinator's name**

Dr. Riyad abu Mallouh

5. **Textbook information**

John Uicker, Gordon Pennock and, Joseph Shigley, Theory of Machines and Mechanisms, 5 edition, McGraw-Hill, 2012.

a. **Other supplemental materials**

Robert Norton, Kinematic and Dynamics of Machinery, McGraw-Hill, 2008.

6. **Specific course information**

a. **Catalog description**

Geometry and the motions of the parts of a machine and the forces that produce this motion. This includes relative motion analysis and design of gears, cams, and linkages, considering static and dynamic forces graphically and analytically.

b. **Prerequisites or co-requisites**

Prerequisite: ME 331 Theory of Machines.

c. **The course is:**

Required in the Mechanical Engineering Department.

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7. **Specific goals for the course**
   a. **Course outcomes:**

After completion of the course, students are expected to be able to:

1. Identify the basic relations between distance, time, velocity, acceleration, and force
2. Apply vector mechanics as a tool for solving dynamic problems.
3. Use graphical and analytic methods to carry out the force analysis of mechanisms.
4. Design different types of mechanisms.
5. Apply the balancing process for different machine elements

b. **The following student outcomes are addressed by the course:**

SO-(e) an ability to identify, formulate, and solve engineering problems.
SO-(pc-3) prepare students to work professionally in mechanical systems.

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1. **Learning Outcomes and their Alignment with Program Educational Objective (PEO's), Methods of Delivery, and Assessment Methods:**

Learning Outcomes	Program PEOs	Method of Delivery	Assessment Method
Course Outcomes			
CO-(1): Identify the basic relations between distance, time, velocity, acceleration, and force.	-	Lectures (Example and Problems)	First Exam
CO-(2): Apply vector mechanics as a tool for solving dynamic problems.	-	Lectures (Example and Problems)	First Exam
CO-(3): Use graphical and analytic methods to carry out the force analysis of mechanisms	-	Lectures (Example and Problems)	Second Exam
CO-(4): Design different types of mechanisms.		Lectures (Example and Problems)	Second Exam
CO-(5): Apply the balancing process for different machine elements		Lectures (Example and Problems)	Final Exam
Student Outcomes			
SO-(e) an ability to identify, formulate, and solve engineering problems.	2	Lectures (Example and Problems)	First Exam
SO-(pc-3) prepare students to work professionally in mechanical systems.	1, 3	Lectures (Example and Problems)	Second Exam

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2. Weekly Teaching Plan

Week No.	Lecture	Topic	Method of Delivery
1	Sun (9-10)	Chapter 9: **Synthesis of Linkages:** Type, Number, and Dimensional Synthesis	Lecture
	Tue (9-10)	Chapter 9: **Synthesis of Linkages:** Function Generation, Path Generation, and Body Guidance	Lecture
	Thu (9-10)	Chapter 9: **Synthesis of Linkages:** Two Finitely Separated Postures of a Rigid Body ($N = 2$)	Online Lecture/ synchronous
2	Sun (9-10)	Chapter 9: **Synthesis of Linkages:** Three Finitely Separated Postures of a Rigid Body ($N = 3$)	Lecture
	Tue (9-10)	Chapter 9: **Synthesis of Linkages:** Four Finitely Separated Postures of a Rigid Body ($N = 4$)	Lecture
	Thu (9-10)	Chapter 9: **Synthesis of Linkages:** Five Finitely Separated Postures of a Rigid Body ($N = 5$)	Online Lecture/ synchronous
3	Sun (9-10)	Chapter 10: **Spatial Mechanisms and Robotics:** Exceptions to the Mobility Criterion	Lecture
	Tue (9-10)	Chapter 10: **Spatial Mechanisms and Robotics:** Spatial Posture-Analysis Problem	Lecture
	Thu (9-10)	Chapter 10: **Spatial Mechanisms and Robotics:** Spatial Velocity and Acceleration Analyses	Online Lecture/ synchronous
4	Sun (9-10)	Chapter 10: **Spatial Mechanisms and Robotics:** Transformation-Matrix Posture Analysis	Lecture
	Tue (9-10)	Chapter 10: **Spatial Mechanisms and Robotics:** Matrix Velocity and Acceleration Analyses	Lecture
	Thu (9-10)	Chapter 10: **Spatial Mechanisms and Robotics:** Introduction to Robotics	Online Lecture
5	Sun (9-10)	Chapter 11: **Static Force Analysis:** Newton's Laws	Lecture
	Tue (9-10)	Chapter 11: **Static Force Analysis:** Applied and Constraint Forces	Lecture
	Thu (9-10)	Chapter 11: **Static Force Analysis:** Free-Body Diagrams	Online Lecture
6	Sun (9-10)	FIRST EXAM	Lecture
	Tue	Chapter 11: **Static Force Analysis:** Conditions for Equilibrium	Lecture

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	(9-10)		
	Thu (9-10)	Chapter 11: **Static Force Analysis:** Two- and Three-Force Members	Online Lecture
7	Sun (9-10)	Chapter 11: **Static Force Analysis:** Four- and More-Force Members	Lecture
	Tue (9-10)	Chapter 12: **Dynamic Force Analysis:** Inertia Forces and d'Alembert's Principle	Lecture
	Thu (9-10)	Chapter 12: **Dynamic Force Analysis:** Principle of Superposition	Online Lecture
8	Sun (9-10)	Chapter 12: **Dynamic Force Analysis:** Planar Rotation about a Fixed Center	Lecture
	Tue (9-10)	Chapter 12: **Dynamic Force Analysis:** Shaking Forces and Moments	Lecture
	Thu (9-10)	Chapter 12: **Dynamic Force Analysis:** Complex-Algebraic Approach	Online Lecture
9	Sun (9-10)	Chapter 12: **Dynamic Force Analysis:** Equation of Motion from Power Equation	Lecture
	Tue (9-10)	Chapter 14: **Dynamics of Reciprocating Engines:** Dynamic Analysis—General	Lecture
	Thu (9-10)	Chapter 14: **Dynamics of Reciprocating Engines:** Gas Forces	Online Lecture
10	Sun (9-10)	Chapter 14: **Dynamics of Reciprocating Engines:** Equivalent Masses	Lecture
	Tue (9-10)	Chapter 14: **Dynamics of Reciprocating Engines:** Equivalent Masses	Lecture
	Thu (9-10)	Chapter 14: **Dynamics of Reciprocating Engines:** Inertia Forces	Online Lecture
11	Sun (9-10)	Chapter 14: **Dynamics of Reciprocating Engines:** Shaking Forces of Engines	Lecture
	Tue (9-10)	SECOND EXAM	Lecture
	Thu (9-10)	Chapter 15: **Balancing:** Static Balancing	Online Lecture/ synchronous
12	Sun (9-10)	Chapter 15: **Balancing:** Dynamic Balancing	Lecture
	Tue (9-10)	Chapter 15: **Balancing:** Balancing a Single-Cylinder Engine	Lecture
	Thu (9-10)	Chapter 15: **Balancing:** Balancing Linkages	Online Lecture/ synchronous
13	Sun (9-10)	Chapter 15: **Balancing:** Balancing of Machines	Lecture

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	Tue (9-10)	Chapter 16: **Flywheels, Governors, and Gyroscopes**: Dynamic Theory of Flywheels	Lecture
	Thu (9-10)	Chapter 16: **Flywheels, Governors, and Gyroscopes**: Integration Technique	Online Lecture/ synchronous
14	Sun (9-10)	Chapter 16: **Flywheels, Governors, and Gyroscopes**: Multi-Cylinder Engine Torque Summation	Lecture
	Tue (9-10)	Chapter 16: **Flywheels, Governors, and Gyroscopes**: Centrifugal Governors	Lecture
	Thu (9-10)	Chapter 16: **Flywheels, Governors, and Gyroscopes**: Inertia Governors	Online Lecture/ synchronous
15	Sun (9-10)	Chapter 16: **Flywheels, Governors, and Gyroscopes**: Mechanical Control Systems	Lecture
	Tue (9-10)	Revision	Lecture
	Thu (9-10)	FINAL EXAM	Online Lecture/ synchronous

3. Grade Distribution:

Assessment	Grade	Week No.
- Midterm Exam	30%	7th Week
-Assignments (Reports /Quizzes/ Seminar / Tutorials/ Home works ….)	20%	1-16th Week
- Final Examination	50%	16th Week

Note: Make-up exams will be offered for valid reasons. It may be different from regular exams in content and format.