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

## Course Syllabus

1. **Course number and name**

ME 331 Theory of Machines

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**

Kinematics of machines; motions of mechanisms; design mechanisms to have given motions; graphical and analytical analysis of position, velocity, and acceleration; relative motion.

b. **Prerequisites or co-requisites**

Prerequisite: ME 211 Dynamics ; CEE 203 Advanced Engineering Mathematics

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. Explain the definitions of a mechanism, machines and motion types
2. Explain the fundamentals of the theory of kinematics of machines.
3. Design simple for bar mechanism using two and three positions synthesis
4. Calculate the position, velocity and acceleration of links using graphical and analytical technique
5. Determine the basic cam profile and SVAJ diagrams
6. Explain the type of gear trains and determine the speed ratio for different gear train systems

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

SO-(a) an ability to apply knowledge of mathematics, science, and engineering

SO-(c) An ability to design a simple four-bar mechanism to meet desired needs within realistic constrains such as economic, environment, social, political, ethical, health and safety, manufacturability, and sustainability.

SO-(e) an ability to identify, formulate, and solve engineering problems

SO-(pc-1) apply principles of engineering, basic science, and mathematics (including multivariate calculus and differential equations); to model, analyze, design, and realize physical systems, components or processes

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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): Explain the definitions of a mechanism, machines and motion types. | - | Lectures (Example and Problems) | First Exam |
| CO-(2): Explain the fundamentals of the theory of kinematics of machines. | - | Lectures (Example and Problems) | First Exam |
| CO-(3): Design simple for bar mechanism using two and three positions synthesis | - | Lectures (Example and Problems) | Second Exam |
| CO-(4): Calculate the position, velocity and acceleration of links using graphical and analytical technique | | Lectures (Example and Problems) | Second Exam |
| CO-(5): Determine the basic cam profile and SVAJ diagrams | | Lectures (Example and Problems) | Final Exam |
| CO-(6): Explain the type of gear trains and determine the speed ratio for different gear train systems | | Lectures (Example and Problems) | Final Exam |
| **Student Outcomes** | | | |
| SO-(a) an ability to apply knowledge of mathematics, science, and engineering. | 2 | Lectures (Example and Problems) | First Exam |
| SO-(c) An ability to design a simple four-bar mechanism to meet desired needs within realistic constrains such as economic, environment, social, political, ethical, health and safety, manufacturability, and sustainability. | 1, 3 | Lectures (Example and Problems) | Second Exam |
| SO-(e) an ability to identify, formulate, and solve engineering problems. | 1 | Lectures (Example and Problems) | Final Exam |

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|---|---|---|---|
| SO-(pc-1) apply principles of engineering, basic science, and mathematics (including multivariate calculus and differential equations); to model, analyze, design, and realize physical systems, components or processes | | Lectures (Example and Problems) | Final Exam |

## 2. Weekly Teaching Plan

| Week No. | Lecture | Topic | Method of Delivery |
|---|---|---|---|
| 1 | Sun (9-10) | Chapter 1: Introduction | Lecture |
| | Tue (9-10) | Chapter 1: Introduction | Lecture |
| | Thu (9-10) | Chapter 2: kinematics: Degrees of Freedom | Lecture |
| 2 | Sun (9-10) | Chapter 2: kinematics: Types of Motion | Lecture |
| | Tue (9-10) | Chapter 2: kinematics: Links, Joints, and Kinematic Chains | Lecture |
| | Thu (9-10) | Chapter 2: kinematics: Mechanisms and Structures | Lecture |
| 3 | Sun (9-10) | Chapter 2: kinematics: The Grashof Condition | Lecture |
| | Tue (9-10) | **Chapter 3 Graphical Linkage Synthesis:** Quick-Return Mechanisms | Lecture |
| | Thu (9-10) | **Chapter 3 Graphical Linkage Synthesis:** Coupler Curves | Lecture |
| 4 | Sun (9-10) | **Chapter 3 Graphical Linkage Synthesis:** Cognates | Lecture |
| | Tue (9-10) | **Chapter 3 Graphical Linkage Synthesis:** Straight-Line Mechanisms | Lecture |
| | Thu (9-10) | **Chapter 3 Graphical Linkage Synthesis:** Dwell Mechanisms | Lecture |
| 5 | Sun (9-10) | **Chapter 4 Position Analysis:** Coordinate Systems | Lecture |
| | Tue (9-10) | **Chapter 4 Position Analysis:** Position and Displacement | Lecture |

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|---|---|---|---|
| | Thu (9-10) | **Chapter 4 Position Analysis:** Translation, Rotation, and Complex Motion | Lecture |
| 6 | Sun (9-10) | **Chapter 4 Position Analysis:** Graphical Position Analysis of Linkages | Lecture |
| | Tue (9-10) | **Chapter 4 Position Analysis:** Algebraic Position Analysis of Linkages | Lecture |
| | Thu (9-10) | FIRST EXAM | Lecture |
| 7 | Sun (9-10) | **Chapter 5 Analytical Linkage Synthesis:** Types of Kinematic Synthesis | Lecture |
| | Tue (9-10) | **Chapter 5 Analytical Linkage Synthesis:** Two-Position Motion Generation by Analytical Synthesis | Lecture |
| | Thu (9-10) | **Chapter 5 Analytical Linkage Synthesis:** Three-Position Motion Generation by Analytical Synthesis | Lecture |
| 8 | Sun (9-10) | **Chapter 5 Analytical Linkage Synthesis:** Four and five-Position Motion Generation | Lecture |
| | Tue (9-10) | Chapter 6: Velocity_Analysis: Graphical Velocity Analysis | Lecture |
| | Thu (9-10) | **Chapter 5 Analytical Linkage Synthesis:** Other Linkage Synthesis Methods | Lecture |
| 9 | Sun (9-10) | **Chapter 6 Velocity Analysis**: Instant_Centers_and_Centrodes | Lecture |
| | Tue (9-10) | Chapter 6: Velocity_Analysis: complex number | Lecture |
| | Thu (9-10) | Chapter 6: Velocity_Analysis: graphical method | Lecture |
| 10 | Sun (9-10) | Chapter 6: Velocity_Analysis: Velocity of Any Point on a Linkage | Lecture |
| | Tue (9-10) | Chapter 7: acceleration_Analysis complex number method | Lecture |
| | Thu (9-10) | Chapter 7: acceleration_Analysis corriolas acceleration graphical | Lecture |
| 11 | Sun (9-10) | Chapter 7: acceleration_Analysis graphical method | Lecture |
| | Tue (9-10) | Chapter 7: Coriolis_Acceleration complex number | Lecture |
| | Thu (9-10) | SECOND EXAM | Lecture |
| 12 | Sun (9-10) | Chapter 8: Cam_Design_1 | Lecture |
| | Tue (9-10) | Chapter 8: Cam_Design_2 | Lecture |

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|---|---|---|---|
| | Thu (9-10) | Chapter 8: Cam_Design_3 | Lecture |
| 13 | Sun (9-10) | Chapter 8: Cam_Design_4 | Lecture |
| | Tue (9-10) | Chapter 9: Gear Types | Lecture |
| | Thu (9-10) | Chapter 9: Epicyclic_Gearing | Lecture |
| 14 | Sun (9-10) | Chapter 9: Gear Trains | Lecture |
| | Tue (9-10) | | Lecture |
| | Thu (9-10) | | Lecture |
| 15 | Sun (9-10) | | Lecture |
| | Tue (9-10) | | Lecture |
| | Thu (9-10) | | Lecture |

## 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.