Class Syllabus – Fall Semester, 115 Academic Year

Department of Mechanical Engineering, National Chung Cheng University

Course Name: ： Mechanisms				Dept.		IBPME
				Course Code		4232101
Instructors	**Ayush Pratap**	Credits	3	Compulsory	Grade	Second-Year
EMI	■Yes ☐ No					
Course type	☐ Humanistic Care Course ■ Problem-oriented Course ☐ Integrate the curriculum ☐ Internship			☐ Competition Special Course ☐ Topic-based courses ☐ Practical courses ☐ Other		

Prerequisites: Applied Mechanics

Class Description：

This course introduces the kinematic analysis and design of mechanical mechanisms, including linkage mechanisms, cam mechanisms, and gear mechanisms. Students learn the principles of mechanism motion, analytical methods, and computer-aided kinematic analysis. Topics include position, velocity, and acceleration analysis, cam profile design, and gear train analysis.

Class Objective：

Students will understand the principles of mechanism kinematics, analyze planar mechanisms, perform position/velocity/acceleration analyses, design cam mechanisms, analyze gear trains, and apply computer-aided methods for mechanism analysis.

Textbooks	1. Waldron, Kinzel & Agrawal, Kinematics, Dynamics, and Design of Machinery. 2. David H. Myszka, Machines & Mechanisms: Applied Kinematic Analysis. Note: *Please respect intellectual property rights and do not illegally photocopy textbooks specified by the instructor.*

An overview of the main points of teaching

Teaching Materials	■ PPT ☐ Self-edited textbooks ■ Self-made instructional videos	■ Course handouts ☐ Teaching Procedures ☐ Other
Teaching Methods	■ Lectures ☐ Oral presentation ☐ Case studies	☐ Group discussion ☐ Problem-oriented learning ☐ Other

Evaluation Tools	■ Mid-term Exam ■ In-class Quiz ■ Homework ☐ Final Report ☐ Other	■ Final Exam ☐ In-class homework ☐ Mid-term Report ■ Special Report ☐ Scales
Teaching Resources	■ Course website ☐ Electronic files of textbooks are available for download ☐ Internship website	
Instructor's Information		

Course Outlines		Teaching Hours				Core Competence
Unit Title	Contents	Lectures	Demo	Practice	Other	
Basic principles	1.Composition of the organization 2.Restraint exercises 3. Movement of the mechanism	6				B1
Linkage Analysis	1.Linkage mechanism 2.Location Analysis 3.Speed Analysis 4. Acceleration Analysis 5. Computer-aided motion analysis	21				B1, B4, B5, B8
Cam mechanism analysis and design	1.Cam mechanism 2.Design of displacement curve 3. Cam profile design 4. Toolpath planning	12				B1, B5
Gear train analysis	1.Gear mechanism 2.Analysis of ordinary gear trains 3.Analysis of circulating gear trains	6				B1, B5

Achievable Core Competence		Achievable Objective
B1	Possess the ability of basic engineering mathematics, solid mechanics, heat flow mechanics, automatic control, materials science and opto-mechanical integration engineering practical analysis	Possesses basic principles and analytical skills in kinetics.
B4	Ability to write programming languages and computer-aided design	The ability to write computer-aided analysis programming languages
B5	Mechanical and opto-electromechanical systems, component design and process planning capabilities	The ability to design and plan mechanical systems and components.
B8	Ability to engage in scientific writing and presentations	The ability to engage in scientific writing and report presentation

Core competencies of the University Division

B1 Possess the ability of basic engineering mathematics, solid mechanics, heat flow mechanics, automatic control, materials science and opto-mechanical integration engineering practical analysis

B2 Ability to absorb and integrate cross-domain knowledge

B3 Ability to perform solid force experiments, heat flow experiments, mechanical project implementation, optoelectronic engineering experiments and analyze data

B4 Ability to write programming languages and computer-aided design

B5 Mechanical and opto-electromechanical systems, component design and process planning capabilities

B6 Ability to identify, analyse and solve professional problems

B7 Ability to implement and innovate

B8 Ability to engage in scientific writing and presentations

B9 Ability to work as a team, communicate effectively and manage the program

B10 Learn general knowledge and demonstrate the ability of engineering ethics, social responsibility and sustainable development

<table>
<tr><td colspan="5">Weekly teaching plan</td></tr>
<tr><td>Course Time</td><td>Course Location</td><td>Grading</td><td>Office hour</td><td>Teaching quality evaluation method</td></tr>
<tr><td>Fri 13:10-16:00</td><td>Engineering Building II R214A</td><td>Classroom Quiz 20%,
Assignments 10 %
Midterm Exam (1)20%
Midterm Exam (2)20%
Final Exam 25%
Attendance & Participation 5 %</td><td>Tuesday:
10 AM to 12 PM</td><td>Questionnaire</td></tr>
<tr><td>Weeks</td><td colspan="3">Teaching & Homework Progress</td><td>Note</td></tr>
<tr><td>1</td><td colspan="3">Introduction, Motivation</td><td></td></tr>
<tr><td>2</td><td colspan="3">Constraint analysis, spatial linkage and degree of freedom</td><td></td></tr>
<tr><td>3</td><td colspan="3">Mechanism design</td><td></td></tr>
<tr><td>4</td><td colspan="3">Linkages with Rolling and Sliding Contacts, and Joints on Moving Sliders</td><td></td></tr>
<tr><td>5</td><td colspan="3">Velocity Analysis</td><td></td></tr>
<tr><td>6</td><td colspan="3">Acceleration Analysis</td><td></td></tr>
<tr><td>7</td><td colspan="3">Mid Term Exam</td><td></td></tr>
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8	Vector loop method for solving speed analysis	
9	Relative acceleration method and vector loop method for solving acceleration analysis	
10	Special mechanism	
11	Cam mechanism	
12	Mid Term Exam	
13	Design of iso-accelerated displacement curves and simple harmonic motion displacement curves, Cycloidal displacement curve, polynomial displacement curve	
14	Cam profile design for flat-end driven members; cam profile design for roller-end driven members; path planning.	
15	Static and dynamic balancing Mechanisms	
16	Gear mechanisms and general gear train analysis	
17	Helical, Bevel, and Worm Gears	
18	**Final Exam**	

Other remarks:

I. About the Course

Mechanisms is a fundamental course in Mechanical Engineering that provides the foundation for understanding the motion and design of mechanical systems. Throughout the semester, students will learn how various mechanisms—including linkages, cams, and gear trains—transmit and control motion in engineering applications. The course combines theoretical concepts with analytical techniques and practical engineering examples to develop problem-solving and design skills.

By the end of the course, students will be able to perform position, velocity, and acceleration analyses of planar mechanisms, design and analyze cam and gear systems, and apply computer-aided methods to solve kinematic problems. These concepts form the basis for advanced studies in machine design, robotics, automation, manufacturing systems, mechatronics, and product development.

Students are encouraged to actively participate in lectures, complete assignments on time, and practice solving engineering problems regularly. Consistent effort throughout the semester will greatly enhance both conceptual understanding and analytical skills. The instructor is committed to providing a supportive, interactive, and inclusive learning environment where students are encouraged to ask questions, discuss ideas, and seek guidance whenever needed.

II. Course Policies and Expectations

1. Quizzes and Examinations

All quizzes, Assignments, midterm examinations, and the final examination are important components of the course assessment. Make-up examinations or quizzes will only be considered under exceptional circumstances (e.g., medical emergencies or officially approved university activities) with appropriate supporting documentation. Personal reasons such as oversleeping, transportation delays, or forgetting the examination schedule will not normally qualify for a make-up assessment.

2. Attendance

Regular attendance is strongly encouraged, as many concepts are developed progressively during lectures. Attendance contributes to your overall learning experience and class participation. Students arriving more than 15 minutes after the start of class or leaving significantly before the end of class may be recorded as absent.

3. Classroom Conduct

Students are expected to demonstrate professionalism and respect throughout the course. Attendance records will be taken periodically. Any dishonest attendance practices, such as asking another student to sign attendance on your behalf or attending only for roll call without participating in class, constitute academic misconduct and will be treated seriously according to university regulations.

4. Leave of Absence

If you are unable to attend class due to an emergency or official university activity, please inform the instructor as early as possible, preferably at least 24 hours in advance by email whenever feasible. Requests should include a clear explanation and any supporting documentation. Approval of leave is at the discretion of the instructor. In emergency situations where advance notice is impossible, please contact the instructor on the same day.

5. Email Communication

When contacting the instructor by email, please use professional email etiquette. Include:

- Your full name
- Student ID
- Course name
- A clear subject line
- A detailed explanation of your request

Emails that do not provide sufficient information may experience delayed responses.

6. Class Participation

Students are encouraged to actively participate in lectures by asking thoughtful questions, contributing to discussions, and answering questions during class. Active participation may be recognized with bonus marks of up to 5%, awarded at the instructor's discretion.

7. Electronic Devices

To maintain an effective learning environment, the use of mobile phones, tablets, and laptops should be limited to course-related activities only. Students are expected to remain attentive throughout the lecture. Repeated use of electronic devices for non-course-related activities, sleeping in class, or engaging in unrelated work may affect participation marks.

8. Academic Integrity During Examinations

Academic honesty is expected at all times.

During examinations:

- Only approved writing materials and a non-programmable engineering calculator are permitted unless otherwise announced.
- Electronic devices, including mobile phones, smart watches, tablets, and communication devices, must not be used.
- Students must work independently and may not communicate with others during the examination.

Any form of cheating, unauthorized collaboration, or possession of prohibited materials will be handled according to the academic integrity regulations of National Chung Cheng University and may result in severe academic penalties.

III. Responsible Use of Artificial Intelligence (AI)

Artificial Intelligence (AI) tools such as ChatGPT, Gemini, Claude, Copilot, and similar systems may be used as supplementary learning resources, but they **should not replace independent learning or critical thinking.**

As this course focuses on developing the fundamental principles of mechanism analysis and engineering problem-solving, students are **strongly encouraged to first study the recommended textbooks, lecture notes, and class materials before consulting AI tools.** Building a solid conceptual foundation is essential for success in advanced mechanical engineering courses.

Students are also encouraged to solve problems independently and draw mechanism diagrams, free-body diagrams, velocity polygons, and kinematic sketches. **Manual sketching helps develop spatial**

visualization, engineering intuition, and analytical skills that cannot be acquired through AI generated figures.

AI-generated solutions should be regarded as a learning aid rather than a substitute for engineering reasoning. Submitting AI-generated work without understanding the underlying concepts, or presenting it as entirely one's own work, constitutes academic misconduct and will be handled according to the academic integrity regulations of National Chung Cheng University.

Educational Philosophy: The objective of this course is not only to obtain correct answers, but also to develop the engineering thinking, visualization skills, analytical ability, and problem-solving mindset that every mechanical engineer must possess. These abilities are best developed through reading, practicing, sketching, discussing, and reasoning independently before seeking assistance from AI tools.