WEST VIRGINIA UNIVERSITY INSTITUTE OF TECHNOLOGY
DEPARTMENT OF MECHANICAL ENGINEERING
COURSE POLICY & SYLLABUS

Fall 2015

COURSE:	MAE 342 – Dynamics of Machines
PREREQUISITES:	MAE 242 – Dynamics
WEB PAGE:	community.wvu.edu/~bpbettig/MAE342
TEXT:	J.J. Uicker, G.R. Pennock, J.E. Shigley, *Theory of Machines and Mechanisms*, 4th Edition, Oxford University Press, New York, 2011
REFERENCES:	1. K.J. Waldron, G.L. Kinzel, *Kinematics, Dynamics, and Design of Machinery*, 2nd Edition, Wiley, 2002. 2. R.L. Norton, *Design of Machinery*, 2nd Edition, McGraw Hill, 1999. 3. Martin, *Kinematics and Dynamics of Machines*, 2nd Edition, McGraw Hill, 1982.
INSTRUCTOR:	Dr. Bernhard Bettig Office: ENGR-301 Phone: 304-442-3289 Email: bpbettig@mail.wvu.edu Office Hours: M 10-12, 2-5; TR 9:30-12; by appointment; or just drop by

A. Course Objectives

Mechanical devices are characterized by the fact that they have mobility and must move to perform their function. This differentiates mechanical engineering from other fields of engineering such as civil engineering, in which structures are generally immobile, and electrical engineering, in which one is generally concerned with the motion of electrons and not structures. The study of kinematics and dynamics of machines is an applied field of mechanical engineering that is concerned with understanding the relationship between the geometry and the motions of the parts of a machine and the forces that produce this motion. The overall objective of this course is to learn how to analyze the motions of mechanisms, design mechanisms to have given motions, and analyze forces in machines. This includes relative motion analysis and design of gears, gear trains, cams, and linkages, simultaneous graphical and analytical analysis of position, velocity, and acceleration, considering static and inertial forces.

On completing the course, the student will be able to:

1. Understand the fundamentals of the theory of kinematics and dynamics of machines.
2. Understand techniques for studying motion of machines and their components.
3. Use computer software packages in modern design of machines.

B. Learning Outcomes

Upon successful completion of this course, the student will be able to:

1. Distinguish kinematic and kinetic motion.
2. Identify the basic relations between distance, time, velocity, and acceleration.
3. Apply vector mechanics as a tool for solving kinematic problems.
4. Create a schematic drawing of a real-world mechanism.

5. Determine the degrees-of-freedom (mobility) of a mechanism.
6. Use graphical and analytic methods to study the motion of a planar mechanism.
7. Use computer software to study the motion of a mechanism.
8. Design basic gear trains.
9. Design basic cam systems.

This course contributes to the assessment of the following program (student) outcomes:

a. an ability to apply knowledge of mathematics, science and engineering
e. an ability to identify, formulate, and solve engineering problems

C. Assessment

1. ATTENDANCE

Attendance is considered very important for maximizing the learning benefits of this course and therefore regular attendance is expected. Learning is motivated through active discussion, demonstration and practice of the topics being studied. You are responsible for all completed work, schedule adjustments and assigned work addressed during class. Please inform your instructor if you are unable to attend any scheduled class session, and obtain notes from any missed lecture(s). It is your responsibility to make arrangements for any planned or unplanned absences (i.e. interviews, illnesses, personal emergencies, etc.).

2. HOMEWORK

Homework is considered very important for understanding the course material. Homework will be assigned from the text or the references after completing the discussion of an independent topic or chapter. All homework will be collected, graded and returned. You are encouraged to work with your friends for better understanding of the material. HOWEVER, YOU ARE REQUIRED TO COMPLETE THE ASSIGNMENTS INDIVIDUALLY IN YOUR OWN WAY. IDENTICALLY LOOKING ASSIGNMENTS WILL BE CONSIDERED COPIED WORK UNLESS PROVED OTHERWISE BY THE STUDENTS. A ZERO GRADE WILL BE GIVEN TO ALL SUCH DUPLICATES IRRESPECTIVE OF THE REASONS. Homework is due the class period after it has been assigned unless another due date is announced. Circumstances beyond your control (i.e. illness, computer system failure, weather, acts of nature, etc.) will be addressed as required.

As well:

- Each problem must have clearly identified sections: Given, Find, Solution.
- The units must be clear for every numeric value.
- All computations must first show equations symbolically and then with numeric values, without any rearrangement of variables.
- All vector equations must clearly distinguish vector variables and show vector diagrams. Solutions with missing vector diagrams will not be graded.
- Submitted work must be neat, on engineering paper. Use a ruler and compass for diagrams; underline or put boxes around answers.
- Convince me you have the correct answer!

3. EXAMS

Two mid-term exams will be given during the semester and a final exam will be given during exam week. All exams will be closed-book, closed-notes, but self-written formula sheet(s) will be allowed. (The maximum number of pages will be stated in class.) The formula sheet(s) may contain figures, equations, formulas, procedures, etc.; but they may not contain any numerical solutions or worked examples. The mid-terms will be in-class during the regular lecture time. The final exam will be given according to the school schedule.

4. GRADING

Your final grade will be computed based on the deliverables and grading scale in the following tables.

Course Deliverables	
Homework assignments	5
2 Midterm Exams (32.5 each)	65
Final Exam	30
Course Total	100

Grading Scale	
A	90-100%
B	80-89%
C	70-79%
D	60-69%
F	< 60%

D. Syllabus

The course will tentatively follow the outline in the following table.

Week	**Lecture Topics**	**Text Reading**	**Homework**
1 (8/17)	Introduction to Kinematics & Dynamics Gear Trains	1.1-1.4 9.1-9.6	 9.1, 9.4, 9.6, 9.14
2 (8/24)	Spur Gears	7.1-7.10	7.1, 7.2, 7.11, 7.13
3 (8/31)	Helical Gears	8.1-8.7	8.1, 8.6
4 (9/7)	Bevel Gears Worm Gears	8.8-8.12 8.13	8.11, 8.13
5 (9/14)	Cam Systems	6.1-6.7	6.1, 6.3
6 (9/21)	Cam Systems	6.8-10	6.7, 6.9
7 (9/28)	Types of Mechanisms Exam 1 (9/30) Solving Vector Problems	1.5-1.10	1.1, 1.5 Handout
8 (10/5)	Position Analysis	2.1-2.10	1.3, 1.15
9 (10/12)	Position Analysis	2.14-2.19	2.9, 2.10, 2.13
10 (10/19)	Position Analysis		Pos. Anal. only: 3.11, 3.15
11 (10/26)	Velocity Analysis Exam 2 (10/28)	3.1-3.11	3.3, 3.5, 3.8

12 (11/2)	Velocity Analysis	3.13-3.17	3.11, 3.15
13 (11/9)	Acceleration Analysis	4.1-4.6	4.4, 4.5, 4.7
14 (11/16)	Acceleration Analysis	4.7-4.10	4.8, 4.32
15 (11/30)	Spatial Mechanisms* Robotics*	Ch. 11 Ch. 12	
16 (12/7)	Review		
17 (12/14)	Final Exam (12/14 at 8:00 am)		

* content is time-permitting

Inclusivity

The West Virginia University community is committed to creating and fostering a positive learning and working environment based on open communication, mutual respect, and inclusion. If you are a person with a disability and anticipate needing any type of accommodation in order to participate in this class, please advise me and make appropriate arrangements with the Office of Disability Services (304.981.6210). For more information on West Virginia University's Diversity, Equity, and Inclusion initiatives, please see http://diversity.wvu.edu.

Academic Integrity

The integrity of the classes offered by any academic institution solidifies the foundation of its mission and cannot be sacrificed to expediency, ignorance, or blatant fraud. Therefore, I will enforce rigorous standards of academic integrity in all aspects and assignments of this course. For the detailed policy of West Virginia University regarding the definitions of acts considered to fall under academic dishonesty and possible ensuing sanctions, please see the Student Conduct Code http://studentlife.wvu.edu/office_of_student_conduct/student_conduct_code. Should you have any questions about possibly improper research citations or references, or any other activity that may be interpreted as an attempt at academic dishonesty, please see me *before* the assignment is due to discuss the matter.