Lesson Plan

Lesson: *Dynamics Lesson #8 – Kinetics of Particles: 2D Rectangular Motion*

Timeframe: Note how long will it take the learner to complete all the activities from pre-class to post-class activities.

Based on 75 min class meeting (2x per week), total of 2.5 hours per class for outside work.

Pre-class: (1 hour)

- ***10 min Video review material***
- ***20 min Reading textbook and notes***
- ***30 min of problem practice (3 simple problems/HW, 10 min each)***

During Class (75 min total):

- ***10 min questions/quiz on review material***
- ***60 min team problem solving (1 warm up/simple, 2 complex)***
- ***5 min wrap-up***

Post-class: (1.5 hour)

- ***45 min each for 2 complex problems/HW***

Materials needed: Describe what items will be needed to complete the in-class activities.

- ***Formula sheet***
- ***Textbook reading notes***
- ***Notes from practice problems, videos and pre-work***
- ***Calculator, pencil, eraser, ruler***

Objectives: List out the basic objectives tied to pre-class activities and the advanced objectives tied to in-class and post-class activities.

Basic:

1. ***Define "Kinetics"***
2. ***Outline key methods used to solve Kinetics problems***
3. ***Determine approach/method to use for Kinetics problems based upon variables of interest***

Advanced:

1. ***Proficient and accurate at sketching both FBDs and KDs***
2. ***Competent at standard problem setup procedure, including diagrams and outline of approach***

3. ***Accurately identifying underlying assumptions/simplifications in book problems in light of real-world problems.***

Background to the Lesson: Note the typical composition of learners in the class, how this lesson fits into the course design/schedule, prerequisite knowledge required, and typical challenges that learners face with this content area.

Learners are typically Junior level students, this is Lesson #8 of a semester long course (8 of 26 Lessons), it takes place after their first Quiz, Lessons 1-7 are required (covering: Introduction to Dynamics, Rectilinear Motion, Projectile Motion, Curvilinear Motion, Polar Coordinates, Relative & Constrained Motion, and Constrained Motion), and learners are typically challenged with: creating accurate FBD and KD, understanding underlying assumptions used to simplify the problem, and outlining the general approach to solving problems.

Introduction to Lesson: Describe the purpose of this content area for learners and an overview of the activities and resources for the flipped lesson.

This Lesson sets the stage for future learning and is the first topic that will be unfamiliar to them. The resources are videos I have created previously related to both content review and step-by-step problem solving. There are also resources with the textbook related to reading quizzes and practice HW problems.

Procedure [Time needed, include additional steps if needed].

Pre-Class Individual Space Activities and Resources: Outline the major steps for the preparatory activities and be sure to tie the steps to the basic learning objectives you have noted above. Note resources required for learner preparation.

Steps	Purpose	Estimated Time	Learning Objective
Step 1: **Watch my review video**	**Brief overview of material needed for Lesson**	**10 min**	• **Define "Kinetics"** • **Outline key methods used to solve Kinetics problems**
Step 2: **Read the Textbook, Chapter 2 – Kinematics of Particles** 1.1 Introduction 2.2 Rectilinear Motion	**Detailed review of materials from short video**	**20 min**	• **Define "Kinetics"** • **Outline key methods used to solve Kinetics problems**

Step 3: **Create detailed solution of 3 simple problems/HW**	**Practice/warm-up problems**	**30 min (10 min each)**	• **Determine approach/method to use for Kinetics problems based upon variables of interest**

In-Class Group Space Activities and Resources. Outline the major steps for the in-class activities and be sure to tie the steps to the advanced learning objectives you have noted above. Also note any resources needed/developed to provide effective active learning activities within class.

Steps	Purpose	Estimated Time	Learning Objective
Step 1: **Conceptual questions via iClicker or quiz on review material**	**Determine level of understanding/areas of misunderstanding for textbook materials and simple problems**	**10 min**	• **Proficient and accurate at sketching both FBDs and KDs** • **Competent at standard problem setup procedure, including diagrams and outline of approach**
Step 2: **Team problem solving (1 warm up/simple, 2 complex)**	**Practice complex problems with peers and guided instruction**	**60 min**	• **Proficient and accurate at sketching both FBDs and KDs** • **Competent at standard problem setup procedure, including diagrams and outline of approach** • **Accurately identifying underlying assumptions/simplifications in book problems in light of real-world problems.**

Step 3: **Wrap-up Activity: list areas where each group needs extra practice or areas that are more challenging**	**Determine areas that students note as more complicated in order to tailor review materials/supplemental material**	**5 min**	**Ability to articulate areas of weakness where supplemental individual review is needed.**

Post-Class Individual Space Activities and Resources. Outline the major steps for the post-class activities and be sure to tie the steps to the advanced learning objectives you have noted above. Also note any resources learners will need to complete any post-class activities assigned after the group space activities.

Steps	Purpose	Estimated Time	Learning Objective
Step 1: **Review list of individual areas of weakness/necessary for additional review**	**Focus on working problems that are more individually challenging to each student (problems in a bank sorted to indicate topic)**	**45 min**	• **Proficient and accurate at sketching both FBDs and KDs** • **Competent at standard problem setup procedure, including diagrams and outline of approach** • **Accurately identifying underlying assumptions/simplifications in book problems in light of real-world problems.**
Step 2: **Create problems for entire class (quiz/test/HW)**	**Ability to originate problems that will indicate level of understanding material covered.**		• **Proficient and accurate at sketching both FBDs and KDs** • **Competent at standard problem setup procedure, including diagrams and outline of approach** • **Accurately identifying underlying assumptions/simplifications in book problems in light of real-world problems.**

Evaluation:

Analysis. In this section, note what you think will work, and what challenges you think you may face in implementation.

In the beginning, it may be challenging to motivate students to complete the pre-work prior to class. Once they see the utility of the pre-work to the in-class and post-work, they should embrace the new style. I will probably just do the flipped style for a few lessons (perhaps one a week) and obtain real-time feedback from students. I will setup grading to make the flipped lessons count as higher participation points in order to help encourage students to do the work.

Connections to Future Lessons. In this section, note how you think this lesson plan connects to your next topics in the course.

All topics in this course revolve around intensive practice of problem solving. Typically, I would do the review then problems on the board where students can just "zone out". With incorporating a mix of both flipped and traditional lessons each week, I hope to energize students to have more confidence in approaching both HW problems and working on tests during class.