Purpose: It is the intention of this Administrative-Master Syllabus to provide a general description of the course, outline the required elements of the course and to lay the foundation for course assessment for the improvement of student learning, as specified by FBISD, regardless of who teaches the course, the timeframe by which it is instructed, or the instructional method by which the course is delivered. It is not intended to restrict the manner by which an individual faculty member teaches the course but to be an administrative tool to aid in the improvement of instruction.

Course Title	Department	Credits	Course Code	Prerequisites
AP Physics C: Mechanics	Science	.75	SC3812	Physics and completion or concurrent enrollment in Calculus

I. PROGRAM INFORMATION

Program Guide Course Description: The AP Physics C course expands on concepts presented in AP Physics 1 and 2, but is limited to the topics of mechanics. The AP Physics C course is the first part of a sequence that is often a very intensive one-year course in college that serves as the foundation in physics for students majoring in the physical sciences or engineering. The AP Physics C course is unique in the fact that its AP exam is administered as two separate one and one-half hour exams; one in mechanics and the other in electricity and magnetism. A student may to take either or both exams and a separate grade is reported for each. Methods of calculus are used wherever appropriate in formulating physical Earth principles and in applying them to physical problems. Laboratory investigations utilize computer applications when possible. This course requires a two hour lab one evening per week. The focus of this course is preparation for successful completion of the AP Physics C: Mechanics exam in May.

Primary Textbook: Mazur, Eric, Daryl Pedigo, Peter A. Dourmashkin, and Ronald J. Bieniek. Principles & Practice of Physics. Boston, Mass.: Pearson, 2015. Print.
ISBN: 9780321957771 Adoption Period: 2014-2022

Optional Text(s) and/or Materials: N/A

Websites: N/A

Course Overview: The AP Physics C: Mechanics course will provide instruction in kinematics; Newton's laws of motion; work, energy and power; systems of particles and linear momentum; circular motion and rotation; and oscillations and gravitation. The AP Physics C course has been designed by the College Board as a course equivalent to the calculus-based college-level physics class. At the end of the course, students will take the AP Physics C exam, which will test their knowledge of both the concepts taught in the classroom and their use of the correct formulas. Lab work is integral to the understanding of the concepts in this course.

College Board Course Requirements: **Concurrently enrolled in calculus or has take calculus**

Grading System: The State Board of Education has set 70 as a minimum passing grade. Written communication of the student's achievement is reported to the parents on a nine weeks basis. When letter grades are recorded, the following conversions are used: 90-100 = A, 80-89 = B, 75-79 = C, 70-74 = D, 69-below = F

Actual student numerical grades are recorded in the grade book and averaged as actual grades. An incomplete (I) is given on a report card if a student, because of illness or for some other excused reason, cannot complete the required work by the end of the reporting period. The work must be made up. The student should contact the teacher to arrange to complete the work. All other grading, reteaching, and retesting procedures set by Fort Bend ISD will be followed.

Attendance: Students must be in attendance a minimum of 90 percent of the days after enrollment in the course.

In the event that grading or attendance guidelines conflict with FBISD district policy, the district policy will be followed.

II. MAIN IDEAS

Course content is structured around learning objectives within six main ideas which organize thoughts about physics.

- Main Idea 1: Kinematics;
- Main Idea 2: Newton's laws of Motion;
- Main Idea 3: Work, energy and power;
- Main Idea 4: Systems of particles and linear momentum;
- Main Idea 5: Circular motion and rotation; and
- Main Idea 6: Oscillations and gravitation.

III. PHYSICS PRACTICES

The aim of AP Physics C courses is to develop the students' abilities to do the following:

1. Read, understand, and interpret physical information – verbal, mathematical, and graphical;
2. Describe and explain the sequence of steps in the analysis of a particular physical phenomenon or problem; that is,
    2a. Describe the idealized model to be used in the analysis of a particular physical phenomenon, including simplifying assumptions where necessary;
    2b. State the concepts or definitions that are applicable in a particular physical phenomenon;
    2c. Specify relevant limitations on applications of principles in a particular physical phenomenon;
    2d. Carry out and describe the steps of an analysis, verbally, mathematically, or graphically;
    2e. Interpret the results or conclusions, including discussion of particular cases of special interest;
3. Use basic mathematical reasoning – arithmetic, algebraic, geometric, trigonometric, or calculus, where appropriate – in a physical situation or problem;
4. Perform experiments and interpret the results of observations, including making an assessment of experimental uncertainties.

IV. LAB INVESTIGATIONS

Lab Requirements: Investigative labs will account a minimum of 20% of the course instruction. Labs begin as a problem for which the students must propose and develop their own solution. They will conduct an experiment to test their ideas, make observations, and take measurements. Finally, they will form conclusions based on their collected measurements, observations, and data and error analysis. Two hour evening labs will be held each week. Students will participate in a minimum of 11 labs. Evening labs allow for a rigorous experience and provide students with the tools and experiences needed to be successful in future scientific studies. Students are required to keep all lab data, calculations, analysis, and conclusions in a lab notebook. The student-directed and inquiry-based laboratory investigations used throughout the course enable students to apply the seven science practices as defined in the Curriculum Framework.

Main Idea	Lab Investigation/Description	Physics Practice 1	Physics Practice 2a	Physics Practice 2b	Physics Practice 2c	Physics Practice 2d	Physics Practice 2e	Physics Practice 3	Physics Practice 4
1	Kinematics with constant acceleration (I) *Air track and interval timers (photogates or CBL™) used to gather data to produce a v versus t graph. Covers slope differential and area-integral concepts. Acceleration of gravity (g) is found experimentally. Introduction to least squares fit.*	✓	✓	✓	✓	✓	✓	✓	✓
1	Kinematics of projectiles (I) *Students study range and "hang time" of projectiles using a launcher. They show derivative/integral relationships between position, velocity, and acceleration.*	✓	✓	✓	✓	✓	✓	✓	✓
1, 5	Kinematics of circular motion (G) *Students will measure the centripetal force on a swinging pendulum and compare the measured force to the calculated force based on the speed of the pendulum and the 'radius' of the pendulum's motion (its length).*	✓	✓	✓	✓	✓	✓	✓	✓
3	Hooke's Law (I) *Students will investigate springs in series and parallel.*	✓	✓	✓	✓	✓	✓	✓	✓
3	Work Done By Friction (I) *Students will experiment to determine the coefficient of friction between an air track cart and masking tape.*	✓	✓	✓	✓	✓	✓	✓	✓

2	Atwood Machine (G) *Student will study the relationship among force, mass, and acceleration using an Atwood's Machine apparatus.*	✓	✓	✓	✓	✓	✓	✓	✓
3	Conservation of Energy (I) *Students will investigate the change of gravitational potential energy, GPE, in to kinetic energy.*	✓	✓	✓	✓	✓	✓	✓	✓
4	Conservation of Momentum (I) *Students will investigate the conservation of linear momentum to understand the three kinds of collisions using an air track.*	✓	✓	✓	✓	✓	✓	✓	✓
4	Impulse Lab (G) *Students will determine the similarities between the change in momentum and the impulse (net force multiplied by time) in a collision.*	✓	✓	✓	✓	✓	✓	✓	✓
5	Conservation of angular momentum (G) *A spinning disk is suddenly hit by a ring or another disk (2 cases) making an inelastic collision. Students will use calculations of final angular velocity is made theoretically and experimentally; and the loss of KE is determined.*	✓	✓	✓	✓	✓	✓	✓	✓
5	Oscillation of a mass-spring system (I) *Students will examine the factors that affect the period of a mass oscillating on the end of a spring.*	✓	✓	✓	✓	✓	✓	✓	✓
6	Physical Pendulum (G) *Students will determine and compare the experimental and calculated period of a physical pendulum.*	✓	✓	✓	✓	✓	✓	✓	✓

(I) Inquiry Lab; (G) Guided Inquiry Lab

V. INSTRUCTIONAL LEARNING ACTIVITIES

The primary learning activities facilitated by the teacher will include:

- concept development discussion – formative assessments are presented to students in small group activities using formats such as computer simulations (PhET or Physlets), Ranking Tasks, and Tipers.
- physics exercise application – problems are assigned and explored by students in small groups using white boards. Students present their solutions in whole-class discussion explaining their reasoning.
- weekly laboratory investigation - a few days before a lab session students are given a lab prompt where they are given the objective(s) and a list of provided materials. They are expected to come to the lab session prepared with a procedure for achieving the stated objective(s).

VI. COURSE LEARNING OUTCOMES/CURRICULUM REQUIREMENTS

Grading Period	Learning Objectives	Topics & Activities	1. Read, understand, and interpret physical information – verbal, mathematical, and graphical	2a. Describe the idealized model to be used in the analysis of a particular physical phenomenon, including simplifying assumptions where necessary	2b. State the concepts or definitions that are applicable in a particular physical phenomenon	2c. Specify relevant limitations on applications of principles in a particular physical phenomenon	2d. Carry out and describe the steps of an analysis, verbally, mathematically, or graphically	2e. Interpret the results or conclusions, including discussion of particular cases of special interest	3. Use basic mathematical reasoning – arithmetic, algebraic, geometric, trigonometric, or calculus, where appropriate – in a physical situation or problem	4. Perform experiments and interpret the results of observations, including making an assessment of experimental uncertainties	Main Idea 1: Kinematics	Main Idea 2: Newton's law of motion	Main Idea 3: Work, energy and power	Main Idea 4: Systems of particles and linear momentum	Main Idea 5: Circular motion and rotation	Main Idea 6: Oscillations and gravitation	Calculus Integration	Chapter, Pages	Est. Time Frame
1st	**Unit 1: Kinematics: 1D Motion**																		
	I.A.1.a.1 I.A.1.a.2 I.A.1.b.1 I.A.1.b.2 I.A.1.c	**Topics:**																	5 days
		Motion with constant acceleration	✓	✓	✓	✓	✓	✓	✓	✓	✓						✓	Ch 1 1 – 27 Ch 2 28 - 52 Ch 3 53 - 74	
		Motion with varying acceleration	✓	✓	✓	✓	✓	✓	✓	✓	✓						✓		
		Activities:																	
		Lab: Video Analysis of Motion (I)	✓	✓	✓	✓	✓	✓	✓	✓	✓						✓		
		Lab: Accelerated Motion (I)	✓	✓	✓	✓	✓	✓	✓	✓	✓						✓		
	Unit 2: Kinematics: 2D Motion																		
	I.A.2.a.1 I.A.2.a.2 I.A.2.a.3 I.A.2.b I.A.2.c.1	**Topics:**																	5 days
		Projectile motion	✓	✓	✓	✓	✓	✓	✓	✓	✓						✓	Ch 2 28 - 52 Ch 3	
		Relative motion	✓	✓	✓	✓	✓	✓	✓	✓	✓								

	I.A.2.c.2	**Activities:**															53 - 74	
		Lab: Projectile Motion (I)	✓	✓	✓	✓	✓	✓	✓	✓	✓						Ch 6 121-146 Ch 10 226-253	
	Unit 3: Newton's Laws of Motion																	
	I.B.1	**Topics:**																
	I.B.2.a.1	Free Body Diagrams	✓	✓	✓	✓	✓	✓	✓	✓		✓						
	I.B.2.a.2 I.B.2.a.3	Static Equilibrium	✓	✓	✓	✓	✓	✓	✓	✓		✓						
	I.B.2.b.1 I.B.2.b.2	Dynamics of Single Particles, drag friction	✓	✓	✓	✓	✓	✓	✓	✓		✓					✓	
	I.B.2.c I.B.2.d.1 I.B.2.d.2	Dynamics of Systems of 2 or more objects	✓	✓	✓	✓	✓	✓	✓	✓		✓					✓	
	I.B.2.d.3 I.B.2.e.1	Circular Motion	✓	✓	✓	✓	✓	✓	✓	✓					✓			Ch 7 148-175 Ch 8 176-201
	I.B.2.e.2 I.B.2.e.3 I.B.2.e.4 I.B.2.e.5 I.B.3.a I.B.3.b I.B.3.c	**Activities:**																5 days
		Lab: Atwood Machine (G)	✓	✓	✓	✓	✓	✓	✓	✓		✓						
	I.B.3.d I.E.1.a I.E.1.b I.E.1.c I.E.1.d.1 I.E.1.d.2	Uniform Circular Motion (G)	✓	✓	✓	✓	✓	✓	✓	✓					✓			
	Unit 4: Work, Energy and Power																	
	I.C.1.a.1	**Topics:**																
	I.C.1.a.2 I.C.1.a.3 I.C.1.a.4	Work-Energy Theorem	✓	✓	✓	✓	✓	✓	✓	✓			✓				✓	Ch 4 75-100
	I.C.1.b.1 I.C.1.b.2	Forces and potential energy	✓	✓	✓	✓	✓	✓	✓	✓			✓				✓	Ch 5 101-120
	I.C.1.b.3 I.C.2.a.1 I.C.2.a.2	Conservation of Mechanical Energy	✓	✓	✓	✓	✓	✓	✓	✓			✓				✓	Ch 9

	I.C.2.b.1 I.C.2.b.2 I.C.2.b.3 I.C.2.b.4 I.C.2.b.5 I.C.3.a.1 I.C.3.a.2 I.C.3.a.3 I.C.3.b.1 I.C.3.b.2 I.C.3.b.3 I.C.3.b.4 I.C.3.c I.C.4.a I.C.4.b	Power	✓	✓	✓	✓	✓	✓	✓	✓			✓				✓	202-225	
		Activities:																	
		Lab: Work Done By Friction and drag (I)	✓	✓	✓	✓	✓	✓	✓	✓			✓				✓		
		Lab: Hooke's Law and Work (I)	✓	✓	✓	✓	✓	✓	✓	✓			✓				✓		
	Unit 5: Linear Momentum																		
	I.D.1.a.1 I.D.1.a.2 I.D.1.a.3 I.D.1.b I.D.1.c I.D.2.a I.D.2.b I.D.2.c I.D.2.d I.D.2.e I.D.3.a.1 I.D.3.a.2 I.D.3.a.3 I.D.3.a.4 I.D.3.a.5 I.D.3.b.1 I.D.3.b.2	**Topics:**																	
		System of Particles	✓	✓	✓	✓	✓	✓	✓	✓				✓				Ch 4 75 - 100	15 days
		Center of Mass	✓	✓	✓	✓	✓	✓	✓	✓				✓			✓		
		Impulse and Momentum	✓	✓	✓	✓	✓	✓	✓	✓				✓			✓		
		Conservation of Linear momentum and collisions	✓	✓	✓	✓	✓	✓	✓	✓				✓					
		Activities:																	
		Lab: Impulse and Momentum (I)	✓	✓	✓	✓	✓	✓	✓	✓				✓			✓		
		Lab: Conservation of Momentum (I)	✓	✓	✓	✓	✓	✓	✓	✓				✓					
2nd	**Unit 6: Gravitation**																		
	I.F.4.a I.F.4.b I.F.4.c I.F.5.a.1 I.F.5.a.2 I.F.5.a.3 I.F.5.b.1 I.F.5.b.2	**Topics:**																	
		Kepler's Laws	✓	✓	✓	✓	✓	✓	✓	✓						✓		Ch 11 254-280	5 days
		Gravitational Force and Field	✓	✓	✓	✓	✓	✓	✓	✓						✓			
		Gravitational Potential Energy	✓	✓	✓	✓	✓	✓	✓	✓						✓			
		Activities:																	

	I.F.5.b.3 I.F.5.b.4	Lab: My Solar System simulation (PhET)	✓	✓	✓	✓	✓	✓	✓	✓						✓			
	Unit 7:	**Rotational Motion**																	
	I.E.2.a.1 I.E.2.a.2 I.E.2.b.1 I.E.2.b.2 I.E.2.c.1 I.E.2.c.2 I.E.2.d.1 I.E.2.d.2 I.E.2.d.3 I.E.2.e I.E.3.a I.E.3.b I.E.3.c.1 I.E.3.c.2 I.E.3.c.3 I.E.3.c.4 I.E.3.c.5 I.E.3.d.1 I.E.3.d.2 I.E.3.d.3 I.E.4.a.1 I.E.4.a.2 I.E.4.a.3 I.E.4.b.1 I.E.4.b.2 I.E.4.b.3 I.E.4.b.4	**Topics:**															Ch 12 281-307	15 days
		Torque and rotational statics	✓	✓	✓	✓	✓	✓	✓	✓					✓		✓		
		Rotational Kinematics and Dynamics	✓	✓	✓	✓	✓	✓	✓	✓					✓		✓		
		Conservation of Angular Law	✓	✓	✓	✓	✓	✓	✓	✓					✓		✓		
		Parallel-Axis Theorem and Moments of Inertia	✓	✓	✓	✓	✓	✓	✓	✓					✓		✓		
		Activities:																	
		Lab: Rotational Kinematics (G)	✓	✓	✓	✓	✓	✓	✓	✓					✓				
		Lab: Rotational Forces and Energy (G)	✓	✓	✓	✓	✓	✓	✓	✓					✓		✓		
	Unit 8:	**Oscillations**																	
	I.F.1.a I.F.1.b I.F.1.c I.F.1.d I.F.1.e I.F.1.f I.F.1.g I.F.1.h I.F.1.i I.F.1.j I.F.2.a	**Topics:**																	10 days
		Simple Harmonic Motion	✓	✓	✓	✓	✓	✓	✓	✓						✓	✓	Ch 15 374-399	
		Mass on a Spring	✓	✓	✓	✓	✓	✓	✓	✓						✓	✓		
		Pendulums	✓	✓	✓	✓	✓	✓	✓	✓						✓	✓		
		Activities:																	
		Lab: Mass-spring system in SHM (I)	✓	✓	✓	✓	✓	✓	✓	✓						✓	✓		

	I.F.2.b I.F.2.c I.F.2.d I.F.2.e I.F.3.a I.F.3.b I.F.3.c I.F.3.d	Lab: Physical Pendulum (G)	✓	✓	✓	✓	✓	✓	✓	✓						✓	✓		

(I) Inquiry Lab; (G) Guided Inquiry Lab