JANET BARRESI
STATE SUPERINTENDENT OF PUBLIC INSTRUCTION
STATE OF OKLAHOMA

MEMORANDUM

TO: The Honorable Members of the State Board of Education

FROM: Janet Barresi

DATE: August 23, 2012

SUBJECT: Application for Focused Field of Career Study, Eastern Oklahoma County Technology Center, Pre-Engineering Academy

State Board approval is requested for the application of the Eastern Oklahoma Technology Center Pre-Engineering Academy, in accordance with 70 O.S. § 11-103.6. All mathematics and science curricula to be offered in the expanded program have been evaluated and approved by appropriate Oklahoma Sate Department of Education curriculum specialists, and all other requirements to complete the Focused Field of Career Study have been addressed with assurance statement included. A copy of the program is provided for your review.

JB:jd

Attachment

EASTERN OKLAHOMA COUNTY TECHNOLOGY CENTER

eoc tech

July 20, 2012

Oklahoma State Board of Education
Oliver Hodge Education Building
2500 North Lincoln Blvd
Oklahoma City, OK 73105

To: Oklahoma State Board of Education

The Eastern Oklahoma County Technology Center board of education at the June 2012 meeting approved a Pre-Engineering Academy Joint Agreement to be extended to the high schools in our district.

The purpose of the agreement is to give sophomores, with a special talent in science and mathematics, an opportunity to participate in EOC Tech's Pre-Engineering Academy. The participating students will take a rigorous math and science course each year of enrollment in the Academy, along with Project Lead the Way Pre-Engineering curriculum. The senior year students will have the option of participating in the Regional Center of the Oklahoma School of Science and Mathematics (OSSM) and the Engineering Design and Development capstone.

The partnering schools who will participate in the joint agreement include: EOC Technology Center application includes the signed joint agreement and corresponding board minutes from each district. The application also includes documentation of Higher Education involvement, the plan of study and course descriptions, the alignment of course content with the Priority Academic Student Skills (PASS), and copies of the academic instructors' teaching certificates.

We look forward to offering the Pre-Engineering program to sophomore students in our district. Thank you for your consideration of the Eastern Oklahoma County Technology Center application for focused field of career study.

Sincerely,

Dr. Terry Underwood
Superintendent

4601 N. Choctaw Road • Choctaw, Oklahoma 73020 • Fax: 405.390.9598 • Phone: 405.390.9591 • Web: eoctech.edu

Application for Focused Field of Career Study
Oklahoma State Board of Education

"Technology centers may offer programs designed in cooperation with institutions of higher education which have an emphasis on a focused field of career study upon approval of the State Board of Education and the independent district board of education. Students in the tenth grade may be allowed to attend these programs for up to one-half (1/2) of a school day and a credit for the units or sets of competencies required in paragraphs 2 and 3 of subsection B of this section shall be given if the courses are taught by a teacher certified in the secondary subject area."
70 O.S. § 11-103.6.

Date of Application: 07/26/2012

Career Technology Site Eastern Oklahoma County Technology Center

Partnering School District(s) Choctaw, Harrah, Jones, Luther High Schools

Partnering Higher Education Institutions(s) Oklahoma State University

Attachments Checklist

- ☑ Joint Program Agreement between the Career Technology Center and the participating school district(s).
- ☑ Signed minutes evidencing local school board approval of focused field of career study by each participating partner school district(s).
- ☑ Documentation of Higher Education Involvement. (This may include but is not limited to meeting agendas and minutes).
- ☑ Documentation of the mathematics and science courses meeting the Oklahoma C3 Common Core and *Priority Academic Student Skills (PASS)* standards where applicable. (Alignment of course content with Oklahoma C3 Common Core). http://sde.state.ok.us
- ☑ Description of Plan of Study and Course Descriptions for the focused field of career study courses.
- ☑ Documentation that the mathematics and/or science teachers are certified in the secondary subject area they teach. (Copy of teacher certification).

1. One electronic copy of course studies to be submitted to Oklahoma Department of Career and Technology Education (ODCTE) by 10^{th} of the month.	YES ☐	NO ☐
2. ODCTE staff will review and respond with comments/questions to submitting party no later than 20^{th} of the month via email.	YES ☐	NO ☐
3. Once ODCTE has listed items to be re-addressed, submitting party will have to respond by 25^{th} of the month via email.	YES ☐	NO ☐
4. Upon receiving corrected materials ODCTE will notify the submitting party if the materials are accepted.	YES ☐	NO ☐
5. The following staff must be included on all communications with ODCTE: • Tina Fugate, tfuga@okcareertech.org • Lynn Hawkins lhawk@okcareertech.org	YES ☐	NO ☐
6. ODCTE will submit Focus Field of Study materials to SDE prior to the 1^{st} of the month.	YES ☐	NO ☐

Pre-Engineering Academy
Joint Program Agreement

Choctaw Public School and Eastern Oklahoma County Technology Center, pursuant to 70 O.S. § 5-117 (c) enter into this Joint Program Agreement to provide the Pre-Engineering Academy to Choctaw Public School.

It is the intention of both parties to participate in the Pre-Engineering Academy, which will be taught at the Eastern Oklahoma County Technology Center. The Academy will provide an opportunity for sophomores, juniors and seniors of Choctaw Public School to attend the Academy for the purpose of taking courses in mathematics, science and pre-engineering. Attached to this Agreement is a chart designating the grades of students and courses to be taught as part of the student's plan of study.

Students participating in the Academy will be jointly enrolled by EOC Tech and Choctaw Public School. Students who are admitted to the Academy will be required to follow the rules and regulations of EOC Tech as outlined in the Student Handbook.

This Agreement, including Attachment I, shall constitute the entire Agreement of the parties. This Agreement may only be modified or amended in writing and signed by both parties as representatives of the respective Boards of Education. This Agreement shall be subject to and interpreted according to Oklahoma Law.

This Agreement shall become effective when approved by the Boards of Education of EOC Tech and Choctaw Public School. A party may determine to terminate the Agreement at the end of the school year and shall provide written notification of such termination to the other party.

EOC Tech, as the sponsoring organization, will:

- Provide students with rigorous, relevant, reality-based knowledge necessary to pursue engineering or engineering technology majors in college,
- Provide hands-on, project and problem-based teaching that adds rigor to technical learning and relevance to traditional academics,
- Meet state and national standards for mathematics, science and technology,
- Offer a complete career/technical concentration with emphasis on both mathematics and science, and
- Link demanding mathematics and science courses with quality academic/technical courses.

Choctaw Public Schools as the cooperating partner, will:

- Permit qualified sophomores, juniors and seniors interested in the field of engineering to enroll in the Pre-Engineering Academy,
- Grant credit for mathematics, science and Pre-Engineering courses that meet the school's graduation and/or college preparatory requirements,
- Support a plan of study that allows sophomores, juniors and seniors to include academic standards and career education options that prepare the individual for the world of work and continuing education, and
- Inform students of the opportunity to receive high school college preparatory credit and college credit through participation in the Pre-Engineering Academy.

Approved by the Eastern Oklahoma County Technology Center Board of Education
On the 26 day of July, 2012
[signature]
Larry Stephens, President
2500 North Lincoln Blvd
Oklahoma City, OK 73105

Approved by the Choctaw Public School Board of Education
On the 25 day of 06, 2012
Pamela C Matherly [signature]
~~Elizabeth Parker, President~~ Pamela Matherly- Vice President
12880 NE 10th
Choctaw, OK 73020

MINUTES OF JUNE 25, 2012 REGULAR MEETING – 7:00 P.M.
CHOCTAW/NICOMA PARK BOARD OF EDUCATION
Ind. Dist. 4, Oklahoma County, Oklahoma

Place of Meeting
Administration Office
12880 N.E. 10th, Choctaw, OK 73020

Pamela Matherly, Vice President called the meeting to order at 7:00 p.m. Roll call established members present: Daryl Crusoe, Clerk, Janice Modisette, Assistant Clerk, and Don Alsup member. Elizabeth Parker, President was absent.

Ms. Matherly called for consideration and approval of the agenda. Ms. Modisette moved and Mr. Crusoe seconded to approve the agenda. The vote was unanimous.

Mr. Crusoe moved and Mr. Alsup seconded, to approve the June 4, 2012 board minutes. The vote was unanimous.

There were no comments from ACT.

There were no comments from ESPO.

There were no comments from the floor regarding agenda items.

Dr. McCharen reported that the administration office staff are getting a lot work done over the summer. We are currently trying to get the budget in order for next year. The Principals wrapped up last week. The site staff will return on August 6th. Dr. McCharen stated that we received some shocking information on Saturday. The Oklahoma State Department of Education had allocated 1.5 million dollar to hire trainers for the new teacher evaluation system. The State Department sent out an email stating that they do not have enough money to train every school district in the State with that amount of funds. State Superintendent Baresi stated that she was keeping the 1.5 million and it would be used to provide trainers. The 1.5 million in not enough to provide the training state wide so the individual districts will be responsible for organizing their training and making up the difference in the amount of funding required to train administrators in your district. We are very frustrated because it is estimated that this training could cost our district approximately $25,000 to $30,000 to complete the training.

There were no comments from the board members.

Mr. Alsup moved, seconded by Ms. Modisette to approve Memorandum of Understanding between Choctaw/Nicoma Park Schools and Community Action Agency of Oklahoma City and Oklahoma/Canadian Counties, Inc. for Head Start Services for the 2012-13 school year. The vote was unanimous.

Kevin Berry, Director of Finance stated that he has been busy working on closing out the year. He stated that revenue is not where he would like for it to be. Ad valorem has not come in as anticipated but State School Land Earnings are way up. He stated that throughout last school year, the expenditures were high. In fact, the utility cost district wide in March of 2011 surpassed the utility cost for the entire fiscal year of 2010-11. In addition to utility costs increasing, the district has also seen an increase in insurance premiums. Insurance quotes will be presented later in the board meeting for approval. With the increase in expenditures, it appears that we will be using a portion of our fund balance. Child Nutrition revenue was looking good until the last month of the school year. With the school year being 5 days shorter than the previous year, it really hurt the program the last month. The expenditures came in a little higher than the revenue in the Child Nutrition Program. Mr. Berry reported that he and other central office staff had recently attended the USSA Law Conference. He stated that some of the new that was received at the conference was pretty depressing.

Ms. Modisette moved, seconded by Mr. Crusoe, to approve encumbrances. Approved were the following: Fund 11 – No's 1248-1279, $94,816.42, Building Fund 21 – Nos. 281-292, $20,816.69, Child Nutrition Fund 22 – No. 154, $25.35, and June 2010 General Obligation Bond 2010-11 – Fund 35, No's 111-112, $4,749.00. The vote was unanimous.

Mr. Alsup moved, seconded by Ms. Modisette to approve property and casualty insurance with Travelers & ACE Westchester for the 2012-13 school year. The vote was unanimous.

Ms. Modisette moved, seconded by Mr. Crusoe, to approve Activity Fund accounts, fundraisers and list of allowed expenditures for FY 2012/13. The vote was unanimous.

Mr. Crusoe moved, seconded by Mr. Alsup, to approve transfer from Activity Fund 963 to the General Fund. The vote was unanimous.

Mr. Crusoe moved, seconded by Ms. Modisette, to approve the continuation of contract with Sooner Copier at an estimated cost of $90,000.00. The vote was unanimous.

Mr. Alsup moved, seconded by Ms. Modisette, to approve workman's compensation provider for the 2012/13 school year. The bid from Beckman (OSAG) was approved at $411,125.00. The vote was unanimous.

Ms. Modisette moved, seconded by Mr. Crusoe, to approve the Activity Fund Transfers. The vote was unanimous.

Mr. Alsup moved, seconded by Mr. Crusoe to approve the renewal of the sublease of District-wide improvements for the fiscal year ending June 30, 2013 as required under the provisions of the Sublease Agreement dated July 1, 2009 between the District and Oklahoma County Finance Authority. The vote was unanimous.

Mr. Alsup moved, seconded by Mr. Crusoe, to approve the Erate Services agreement for 2013-14 with Collect-Ed LLC. The vote was unanimous.

Ms. Modisette moved, seconded by Mr. Crusoe, to approve a budget revision for the building fund. The vote was unanimous.

Mr. Alsup moved, seconded by Mr. Crusoe, to approve the consent agenda. The vote was unanimous.

Mr. Crusoe moved, seconded by Mr. Alsup to approve the contract with the Oklahoma Virtual Charter Academy. The vote was unanimous.

Ms. Modisette moved, seconded by Mr. Alsup to approve the Pre-Engineering Academy Joint Program Agreement with Eastern Oklahoma County Technology Center. The vote was unanimous.

The board chose to not enter into executive session.

Ms. Modisette moved, seconded by Mr. Crusoe, to approve certified resignations of : : Abigail Cramer, effective 5/24/12; Chris Maggart, effective 5/24/12; Angie Metheny, effective 5/24/12; Cathy Botts, effective 5/24/12; Samantha Pierce, effective 5/24/12; Amanda Castleberry, effective 5/24/12; and Ruth Roy, effective 5/24/12. The vote was unanimous.

Mr. Alsup moved, seconded by Mr. Crusoe to approve certified recommendations of: Shannon Mackey, effective 6/11/12; Kayleen Cointepas, effective 6/14/12; Darren Solomon, effective 6/19/12; Cameron Bennett, effective 6/14/12; Tom Plunkett, effective 6/6/12; Mark Grubbs, effective 6/20/12; Dorothy Wagner, effective 6/6/12; Julia Davenport, effective 6/13/12; Julie Cheek, effective 6/13/12; Amanda Bartlett, effective 6/12/12; Natalie West, effective 6/11/12; Robin Stephens, effective 6/12/12; and Megan Bain, effective 6/12/12. The vote was unanimous.

Mr. Crusoe moved, seconded by Mr. Alsup, to approve the support resignations of: Larry Bessinger, effective 6/30/12; and Willie Stephens, 6/30/12. The vote was unanimous.

Ms. Modisette moved, seconded by Mr. Crusoe, to approve support recommendations of: Amanda Bennett, effective 8/15/12; Arlene Walcott, effective 8/15/12; Erica Bryan, 8/15/12; Kenneth Dixon, effective 7/2/12; Jennifer Meinke, effective 8/15/12; Carrie Bivens, effective 8/21/12; Steve Kutulas, effective 7/2/12; Misty Preble, effective 8/15/12; and Stephanie Pollard, effective 8/6/12. The vote was unanimous.

Under new business, Dr. McCharen requested that the July 9th board meeting be changed to July 16th if all board members were in agreement. All board members agreed and a change of meeting notice will be sent to the Oklahoma County Clerk's office.

There being no further business, the board meeting adjourned upon unanimous consent of the members at 7:32 p.m. following a motion made by Mr. Crusoe and seconded by Ms. Modisette.

BOARD OF EDUCATION:

Elizabeth Parker, President	Pamela Matherly, Vice President	Daryl Crusoe, Clerk
Janice Modisette, Asst. Clerk	James (Don) Alsup, Member	

Pre-Engineering Academy
Joint Program Agreement

Harrah Public School and Eastern Oklahoma County Technology Center, pursuant to 70 O.S. § 5-117 (c) enter into this Joint Program Agreement to provide the Pre-Engineering Academy to Harrah Public School.

It is the intention of both parties to participate in the Pre-Engineering Academy, which will be taught at the Eastern Oklahoma County Technology Center. The Academy will provide an opportunity for sophomores, juniors and seniors of Harrah Public School to attend the Academy for the purpose of taking courses in mathematics, science and pre-engineering. Attached to this Agreement is a chart designating the grades of students and courses to be taught as part of the student's plan of study.

Students participating in the Academy will be jointly enrolled by EOC Tech and Harrah Public School. Students who are admitted to the Academy will be required to follow the rules and regulations of EOC Tech as outlined in the Student Handbook.

This Agreement, including Attachment I, shall constitute the entire Agreement of the parties. This Agreement may only be modified or amended in writing and signed by both parties as representatives of the respective Boards of Education. This Agreement shall be subject to and interpreted according to Oklahoma Law.

This Agreement shall become effective when approved by the Boards of Education of EOC Tech and Harrah Public School. A party may determine to terminate the Agreement at the end of the school year and shall provide written notification of such termination to the other party.

EOC Tech, as the sponsoring organization, will:

- Provide students with rigorous, relevant, reality-based knowledge necessary to pursue engineering or engineering technology majors in college,
- Provide hands-on, project and problem-based teaching that adds rigor to technical learning and relevance to traditional academics,
- Meet state and national standards for mathematics, science and technology,
- Offer a complete career/technical concentration with emphasis on both mathematics and science, and
- Link demanding mathematics and science courses with quality academic/technical courses.

Harrah Public Schools as the cooperating partner, will:

- Permit qualified sophomores, juniors and seniors interested in the field of engineering to enroll in the Pre-Engineering Academy,
- Grant credit for mathematics, science and Pre-Engineering courses that meet the school's graduation and/or college preparatory requirements,
- Support a plan of study that allows sophomores, juniors and seniors to include academic standards and career education options that prepare the individual for the world of work and continuing education, and
- Inform students of the opportunity to receive high school college preparatory credit and college credit through participation in the Pre-Engineering Academy.

Approved by the Eastern Oklahoma County Technology Center Board of Education
On the 26 day of July 2012

Larry Stephens, President
2500 North Lincoln Blvd
Oklahoma City, OK 73105

Approved by the Harrah Public School Board of Education
On the 9th day of July, 2012

Brenda Lusher, President
20670 Walker St.
Harrah, OK 73045

The Board of Education of the School of Luther, county of Oklahoma, met in Regular session on June 28, 2012, at 7:30 p.m. in the Board Room, 18955 NE 178th, Luther, Oklahoma.

Meeting was called to order by Aaron Bachhofer at 7:30 p.m. on June 28, 2012. Board Members present: Aaron Bachhofer, Donita Mackey, Matt Mohr, Ray Stanfield, and Patrice Christy.

Motion made by Patrice Christy and second by Ray Stanfield to consent to agenda. Aaron Bachhofer yes, Donita Mackey yes, Matt Mohr yes, Ray Stanfield yes, and Patrice Christy yes.

Motion made by Patrice Christy and second by Donita Mackey to approve June 4th, 2012 Regular Board Meeting minutes. Aaron Bachhofer yes, Donita Mackey yes, Matt Mohr yes, Ray Stanfield yes, and Patrice Christy yes.

Motion made by Patrice Christy and second by Donita Mackey to approve claims and encumbrances. Aaron Bachhofer yes, Donita Mackey yes, Matt Mohr yes, Ray Stanfield yes, and Patrice Christy yes.

Motion made by Donita Mackey and second by Patrice Christy to approve activity report. Aaron Bachhofer yes, Donita Mackey yes, Matt Mohr yes, Ray Stanfield yes, and Patrice Christy yes.

Superintendents Reports: Summer Update, Financial Report, Construction Update.

Motion made by Patrice Christy and second by Ray Stanfield to approve the Design Development documents, and authorize LWPB and CMSWillowbrook to proceed with Construction Documents phase. Aaron Bachhofer yes, Donita Mackey yes, Matt Mohr yes, Ray Stanfield yes, and Patrice Christy yes.

Motion made by Patrice Christy and second by Ray Stanfield to file Form 307 in General Fund account for 2011-2012 school year. Aaron Bachhofer yes, Donita Mackey yes, Matt Mohr yes, Ray Stanfield yes, and Patrice Christy yes.

Motion made by Donita Mackey and second by Matt Mohr to enter into a Joint Program Agreement to provide the Pre-Engineering Academy with the Eastern Oklahoma county Technology Center. Aaron Bachhofer yes, Donita Mackey yes, Matt Mohr yes, Ray Stanfield yes, and Patrice Christy yes.

Motion made by Donita Mackey and second by Matt Mohr to approve the stipend rate not to exceed $200 per day for in-service training that are outside the teaching contract as determined by the superintendent effective July 1, 2012. Aaron Bachhofer yes, Donita Mackey yes, Matt Mohr yes, Ray Stanfield yes, and Patrice Christy yes.

Motion made by Donita Mackey and second by Matt Mohr to go into Proposed Executi8ve Session pursuant to Oklahoma Statues, Title 25, 307 (b) (5), to discuss property wages, hours, teacher evaluations and employment of certified and non-certified personnel. Aaron Bachhofer yes, Donita Mackey yes, Matt Mohr yes, Ray Stanfield yes, and Patrice Christy yes.

Motion made by Donita Mackey and second by Patrice Christy to reconvene to Open Session.

Aaron Bachhofer yes, Donita Mackey yes, Matt Mohr yes, Ray Stanfield yes, and Patrice Christy yes.

Statement of Executive Session minutes: discussed property wages, hours, teacher evaluation and employment of certified and non-certified personnel with all five Board Members,3 Principals, and Superintendent present.

Motion made by Patrice Christy and second by Ray Stanfield to accept Marcus Smith's letter of resignation from Luther Public School. Aaron Bachhofer yes, Donita Mackey yes, Matt Mohr yes, Ray Stanfield yes, and Patrice Christy yes.

Motion made by Patrice Christy and second by Donita Mackey to accept Anne Blanchard's letter of resignation from Luther Public Schools. Aaron Bachhofer yes, Donita Mackey yes, Matt Mohr yes, Ray Stanfield yes, and Patrice Christy yes.

Motion made by Patrice Christy and second by Donita Mackey to approve the followint certified teachers for the 2012-2013 school year:

1. Teri Tulane-Middle School Teacher
2. Debra Deskin-Elementary Teacher
3. Kristy Barron-High School Teacher
4. Hillary Moore-High School Teacher
5. Debra Reid-High School Teacher
6. Holly McBride-Elementary Teacher

Motion made by Patrice Christy and second by Donita Mackey to hire Nettie Jean Habben as school treasurer for th 2012-2013 School Year and to approve surety bond as required by the court clerk. Aaron Bachhofer yes, Donita Mackey yes, Matt Mohr yes, Ray Stanfield yes, and Patrice Christy yes.

New Business: NONE

Comments from Patrons: NONE

Motion made by Patrice Christy and second by Donita Mackey to adjourn. Aaron Bachhofer yes, Donita Mackey yes, Matt Mohr yes, Ray Stanfield yes, and Patrice Christy yes.

Signed:

President:

V. President:

Clerk:

Member:

Member:

Pre-Engineering Academy
Joint Program Agreement

Jones Public School and Eastern Oklahoma County Technology Center, pursuant to 70 O.S. § 5-117 (c) enter into this Joint Program Agreement to provide the Pre-Engineering Academy to Jones Public School.

It is the intention of both parties to participate in the Pre-Engineering Academy, which will be taught at the Eastern Oklahoma County Technology Center. The Academy will provide an opportunity for sophomores, juniors and seniors of Jones Public School to attend the Academy for the purpose of taking courses in mathematics, science and pre-engineering. Attached to this Agreement is a chart designating the grades of students and courses to be taught as part of the student's plan of study.

Students participating in the Academy will be jointly enrolled by EOC Tech and Jones Public School. Students who are admitted to the Academy will be required to follow the rules and regulations of EOC Tech as outlined in the Student Handbook.

This Agreement, including Attachment I, shall constitute the entire Agreement of the parties. This Agreement may only be modified or amended in writing and signed by both parties as representatives of the respective Boards of Education. This Agreement shall be subject to and interpreted according to Oklahoma Law.

This Agreement shall become effective when approved by the Boards of Education of EOC Tech and Jones Public School. A party may determine to terminate the Agreement at the end of the school year and shall provide written notification of such termination to the other party.

EOC Tech, as the sponsoring organization, will:

- Provide students with rigorous, relevant, reality-based knowledge necessary to pursue engineering or engineering technology majors in college,
- Provide hands-on, project and problem-based teaching that adds rigor to technical learning and relevance to traditional academics,
- Meet state and national standards for mathematics, science and technology,
- Offer a complete career/technical concentration with emphasis on both mathematics and science, and
- Link demanding mathematics and science courses with quality academic/technical courses.

Jones Public Schools as the cooperating partner, will:

- Permit qualified sophomores, juniors and seniors interested in the field of engineering to enroll in the Pre-Engineering Academy,
- Grant credit for mathematics, science and Pre-Engineering courses that meet the school's graduation and/or college preparatory requirements,
- Support a plan of study that allows sophomores, juniors and seniors to include academic standards and career education options that prepare the individual for the world of work and continuing education, and
- Inform students of the opportunity to receive high school college preparatory credit and college credit through participation in the Pre-Engineering Academy.

Approved by the Eastern Oklahoma County Technology Center Board of Education
On the 26 day of July 2012

Larry Stephens, President
2500 North Lincoln Blvd
Oklahoma City, OK 73105

Approved by the Jones Public School Board of Education
On the 11th day of June, 2012

Ken Guthery, President
302 Dr. Lee Simons St.
Administration Building

REGULAR MEETING

Monday, June 11, 2012 5:30 p.m. Administration Building

The regular meeting of the Jones Board of Education was called to order by the president, Ken Guthery. Roll call followed: Shree Young – present, Brett Ramsey – absent, James Selders – absent, Eric Williams – present, Ken Guthery – present.

Quorum established.

1. Motion made by Shree Young to approve the minutes from the regular meeting of May 7, 2012. Seconded by Eric Williams. Shree Young – yes, Eric Williams – yes, Brett Ramsey – absent, James Selders – absent, Ken Guthery – yes. 3 yes and 2 absent.

2. Motion made by Shree Young to approve encumbrances totaling $123,360.74 and warrants supported by proper invoice totaling $113,791.25 from the General Fund. Seconded by Eric Williams. James Selders – absent, Brett Ramsey – absent, Shree Young – yes, Eric Williams – yes, Ken Guthery – yes. 3 yes and 2 absent.

3. Motion made by Shree Young to approve encumbrances totaling $31,468.99 and warrants supported by proper invoice totaling $10,984.06 from the Building Fund. Seconded by Eric Williams. James Selders – absent, Brett Ramsey – absent, Shree Young – yes, Eric Williams – yes, Ken Guthery – yes. 3 yes and 2 absent.

4. Motion made by Shree Young to approve encumbrances totaling $53.75 and warrants supported by proper invoice totaling $30,114.56 from the Child Nutrition Fund. Seconded by Eric Williams. Eric Williams – yes, Shree Young – yes, James Selders – absent, Brett Ramsey – absent, Ken Guthery – yes. 3 yes and 2 absent.

5. Motion made by Shree Young to approve encumbrances totaling $75.00 and warrants supported by proper invoice totaling $75.00 from the Gift Fund. Seconded by Eric Williams. Shree Young – yes, Eric Williams – yes, James Selders – absent, Brett Ramsey – absent, Ken Guthery – yes. 3 yes and 2 absent.

James Selders arrived at the meeting at 5:39 p.m.

6. Motion made by Shree Young to approve as presented the transfer of funds of $200.00 from the Class of 2012 to High School Cheer and $50.00 from Middle School Drama to the Clearing Account. Seconded by Eric Williams. Eric Williams – yes, Shree Young – yes, James Selders – abstain, Brett Ramsey – absent, Ken Guthery – yes. 3 yes, 1 abstention, and 1 absent.

7. Motion made by Shree Young to approve as presented the temporary appropriations for the 2012-2013 fiscal year. Seconded by James Selders. James Selders – yes, Brett Ramsey –absent, Eric Williams – yes, Shree Young – yes, Ken Guthery – yes. 4 yes and 1 absent.

28. Motion made by Shree Young to hire certified personnel, Robert Neil, Cindy Newby, Justin Raper, Katie Smith, Shelly Wear, and Katelyn Westlund (contingent upon proper certification) and non-certified personnel, Sherrie Loewen and Edmond Robison. Seconded by James Selders. Eric Williams – yes, James Selders – yes, Brett Ramsey – absent, Shree Young – yes, Ken Guthery – yes. 4 yes and 1 absent.

29. Motion made by Shree Young to approve as presented the Pre-Engineering Academy Joint Program Agreement with Eastern Oklahoma County Tech Center. Seconded by James Selders. James Selders – yes, Brett Ramsey – absent, Eric Williams – yes, Shree Young – yes, Ken Guthery – yes. 4 yes and 1 absent.

30. Motion made by Shree Young to adjourn. Seconded by James Selders. James Selders – yes, Shree Young – yes, Eric Williams – yes, Brett Ramsey – absent, Ken Guthery – yes. 4 yes and 1 absent.

Adjourned 8:45 p.m.

President	V-President
Clerk	Member
Member	7-9-12 Date

June 16, 2012

Dr. Terry Underwood
Eastern Oklahoma County Technology Center
4601 N. Choctaw Road
Choctaw, Ok 73020

Dr. Underwood:

As a representative of Oklahoma State University's College of Engineering, Architecture, Technology (CEAT) it is my responsibility to support the Pre-Engineering Academies initiated by the State Department of Career Tech. My role includes interacting with students and teachers in the classroom, participating on the Pre-Engineering Academy Advisory Boards, and serving as a liaison between Oklahoma State University and the academies.

I was very pleased to learn that Eastern Oklahoma County Career Tech is in the process of initiating a Pre-Engineering Academy for 2012-13, which I strongly support. The College of Engineering, Architecture, Technology has observed an increase in both the quality of students and the number of students enrolling at Oklahoma State University since the pre-engineering academies have been established.

The first academy was established in 2005, and there are currently eighteen active academies. I absolutely support having a sophomore component as part of your academy.

Several of the current academies have added sophomores to their program as they discovered junior students entering the pre-engineering curriculum were not prepared for the mathematic requirements. As a result of adding a sophomore component, the academies have been able to add AP Calculus and AP Physics to their curriculum. This in turn allows students to be more successful in their pursuit of an engineering degree.

Dr. Eric Reynolds has requested that I serve on your advisory board. I would be please to participate in supporting your program.

Sincerely,

Dr. Virgil Nichols, PhD
College of Engineering, Architecture, Technology
Engineering North, Room 101
Oklahoma State University
Stillwater, Oklahoma 74078
Home: 405-372-5989
Cell: 405-714-2363
virgil.nichols@okstate.edu

Algebra II Course Description

Algebra II– This course will enhance and expand the mathematical foundations of Algebra I and Geometry. The course will stress the fundamental extension of previous mathematics and the preparation for future higher-level mathematics courses. It will involve operations with real and complex numbers as well as matrices. The problem solving processes will use functions and relations. Within the course applications of math, and while satisfying predictions based on a set of data, the use of data analysis, and statistics will be justified. Students who master Algebra II will gain experience with quadratic functions, conic sections, logarithmic and exponential functions, linear functions, solution methods for systems of linear functions, and matrix operations.

eoc tech

Eastern Oklahoma County
Technology Center
4601 N. Choctaw Rd., Choctaw, OK
390.9591 | www.eoctech.edu

Course Syllabus

Course Title: *Algebra II*

Description

This course will enhance and expand the mathematical foundations of Algebra I and Geometry. The course will stress the fundamental extension of previous mathematics and the preparation for future higher-level mathematics courses. It will involve operations with real and complex numbers as well as matrices. The problem solving processes will use functions and relations. Within the course applications of math, and while satisfying predictions based on a set of data, the use of data analysis, and statistics will be justified. Students who master Algebra II will gain experience with quadratic functions, conic sections, logarithmic and exponential functions, linear functions, solution methods for systems of linear functions, and matrix operations.

Text: Algebra II, Integration, Application, Connections, Glencoe/McGraw-Hill (2007); Foster; Winters; Gordon; Rath; Collins; Cuevas; Moore-Harris; Swart

Instructor
Jana Gaddis
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jgaddis@eoctech.org

Course Number OCAS Number	OHLAP Credit	Length	Prerequisites
ST00006 4412	Yes	120 Clock Hours	Algebra I, Geometry

Objectives/Knowledge and Skills:

These courses are to be taught by a highly qualified teacher with an Oklahoma Intermediate or Advanced Mathematics teaching certification. The students should be in the eleventh or twelfth grade or if a sophomore, they should be in a Focused Field of Career Study program. The course will have at a minimum, but may exceed, a duration of 120 hours within a school year.

The following grade scale will be used:

A = 100-90
B = 89-80
C = 79-70
D = 69-60
F = 59-below

The student will have one school year to complete this course.

Makeup work policies: *All* work missed due to an ***excused*** absence, including school activity, must be turned in within three (3) school days of the date of absence in order to receive full credit. The student must make arrangements with the instructor, in advance if possible, to schedule make-up work due to an extended absence situation.

Referenced Standards

Objective	OK C3 Standards
Polynomial, Rational, and Radical Relationships	
Perform arithmetic operations with complex numbers.	N.CN.1, N.CN.2
Use complex numbers in polynomial identities and equations.	N.CN.7, N.CN.8(+), N.CN.9(+)
Interpret the structure of expressions.	A.SSE.1, A.SSE.2
Perform arithmetic operations on polynomials.	
Understand the relationship between zeros and factors of polynomials.	A.APR.2, A.APR.3
Trigonometric Functions	
Extend the domain of trigonometric functions using the unit circle.	F.TF.1, F.TF.2
Model periodic phenomena with trigonometric functions.	F.TF.5
Prove and apply trigonometric identities.	F.TF.8
Modeling with Functions	
Create equations that describe numbers or relationships.	A.CED.1, A.CED.2, A.CED.3, A.CED.4
Interpret functions that arise in applications in terms of a context.	F.IF.4, F.IF.5, F.IF.6
Inferences and Conclusions from Data	
Summarize, represent, and interpret data on a single count or measurement variable.	S.ID.4
Understand and evaluate random processes underlying statistical experiments.	S.IC.1, S.IC.2
Make inferences and justify conclusions from sample surveys, experiments, and observational studies.	S.IC.3, S.IC.4, S.IC.5, S.IC.6
Inferences and Conclusions from Data Continued	
Use probability to evaluate outcomes of decisions.	S.MD.6(+), S.MD.7(+)
Standards for Mathematical Practice	
Make sense of problems and persevere in solving them.	
Reason abstractly and quantitatively.	
Construct viable arguments and critique the reasoning of others.	
Model with mathematics.	
Use appropriate tools strategically.	
Attend to precision.	
Look for and make use of structure.	
Look for and express regularity in repeated reasoning.	

Pre-Calculus with Trigonometry Course Description

Students enrolled in Pre-Calculus/Trigonometry receive rigorous and relevant curriculum that will enable them to be successful in upper level mathematics. Students are expected to problem solve, do reasoning and proofs, demonstrate mathematical communication, connect and link mathematical ideas to real-world and other disciplines, and use mathematical representations for modeling, interpreting, and communicating. Technology will be integrated into the course in order to prepare students for real-world situations.

This course is designed to be in preparation for Calculus or AP Calculus. A graphing calculator is recommended.
The first part of the course includes a study of six basic functions of trigonometry, solutions of right and oblique triangles, identities, and complex numbers. The calculator is used as an aide to computations. The second half of the course gives a review study of straight lines, conic sections, simplification of equations, algebraic curves, transcendental curves, a completed study of straight lines, simplification of equations, polar coordinates, and an introduction to limits and derivatives. Prerequisites for this course are: Algebra I, Geometry, Algebra II

Course Title: *Pre-Calculus/Trigonometry*

Description

This course is designed to be in preparation for Calculus or AP Calculus. A graphing calculator is recommended. The first part of the course includes a study of six basic functions of trigonometry, solutions of right and oblique triangles, identities, and complex numbers. The calculator is used as an aid to computations. The second half of the course gives a review study of straight lines, conic sections, simplification of equations, algebraic curves, transcendental curves, a completed study of straight lines, simplification of equations, polar coordinates, and an introduction to limits and derivatives.

Text: Pre-Calculus with Limits; McDougall Littell Larsim, Ron; Hostetter, Bob, 2007

Instructor
Jana Gaddis
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CTE Number OCAS Numbers	OHLAP Credit	Length	Prerequisites
ST00010 4611/4750	Yes	120 Clock Hours	Algebra I, Algebra II, Geometry,

Referenced Standards

National Science Standards (5th ed). (1998). National Research Council, Washington, D.C., National Academy of Sciences

The following grade scale will be used:

A = 100-90
B = 89-80
C = 79-70
D = 69-60
F = 59-below

The student will have one school year to complete this course. Students will participate in class discussion, make presentations, effectively demonstrate physical skills, and pass written tests.

Makeup work policies: *All* work missed due to an ***excused*** absence, including school activity, must be turned in within three (3) school days of the date of absence in order to receive full credit. The student must make arrangements with the instructor, in advance if possible, to schedule make-up work due to an extended absence situation.

Requirements for College Admission Status (Title 70 O.S. § 11-103.6)
These courses are to be taught by a highly qualified teacher with an Oklahoma Physics teaching certification. The students should be in the eleventh or twelfth grade or if a sophomore, they should be in a Focused Field of

Career Study program. The course should consist of 40% laboratory or fieldwork in order to be considered a lab science. The course will have at a minimum, but may exceed, a duration of 120 hours within a school year (72 hours theory/48 lab hours).

Objective	OK C3 Standards
The Complex Number System	
Perform arithmetic operations with complex numbers.	N.NC.3
Represent complex numbers and their operations on the complex plane.	N.NC.4, N.NC.5, N.NC.6
Vector and Matrix Quantities	
Represent and model with vector quantities.	N.VM.1, N.VM.2, N.VM.3
Perform operations on vectors.	N.VM.4a, b, c; N.VM.5a, b
Perform operations on matrices and use matrices in applications.	N.VM.6, N.VM.7, N.VM.8, N.VM.9, N.VM.10, N.VM.11, N.VM.12
Reasoning with Equations and Inequalities	
Solve systems of equations	A.REI.8, A.REI.9
Interpreting Functions	
Analyze functions using different representations	F.IF.7, F.IF.7d
Building Functions	
Build a function that models a relationship between two quantities	F.BF.1, F.BF.1c
Build new functions from existing functions	F.BF.4b,c,d; F.BF.5
Trigonometric Functions	
Extend the domain of trigonometric functions using the unit circle.	F.TF.3, F.TF.4
Model periodic phenomena with trigonometric functions	F.TF.6, F.TF.7, F.TF.9
Expressing Geometric Properties with Equations	
Translate between the geometric description and the equation for a conic section.	G.GPE.3
Geometric Measurement and Dimension	
Explain volume formulas and use them to solve problems.	G.GMD.2
Using Probability to Make Decisions	
Calculate expected values and use them to solve problems	S.MD.1, S.MD.2, S.MD.3, S.MD.4
Use probability to evaluate outcomes of decisions	S.MD.5a, b
Standards for Mathematical Practice	
Make sense of problems and persevere in solving them.	
Reason abstractly and quantitatively.	
Construct viable arguments and critique the reasoning of others.	
Model with mathematics.	
Use appropriate tools strategically.	
Attend to precision.	
Look for and make use of structure.	
Look for and express regularity in repeated	

reasoning.	

Pre AP Physics Course Description

Physics I is the study of the nature of matter and energy and how they interrelate. It provides the student with a foundation for understanding concepts and laws of modern physics, as well as providing a good foundation for AP Physics course curriculum. Physics I is aligned with Oklahoma Priority Academic Student Skills (PASS) and National Science Education Standards. Physics education is essential for those preparing for a career in science and those that will be touched by aspects of it through technology, medicine, engineering, architecture, biomechanics, and many other related fields. Physics I gives the student hands-on lab experience and reinforces crucial math & critical thinking skills.

Physics I gives the student a set of basic models in the core content of Physics. The student will collaboratively make and use these models to describe, explain, predict, design, and control physical phenomena. Technology is an essential tool used throughout the course to collect, organize, analyze, visualize, and model real data which allows the student to conceptually understand the principles of Physics. Students will then be able to evaluate scientific models through comparisons with empirical data. This course focuses on the development of the student as a scientist through the study of physics. Being a scientist requires a broad set of tools, including theory, problem solving, written and oral communication, interpreting data and laboratory skills.

This course will cover kinematics in one and two dimensions, as well as forces and vectors. Students will study work, energy, and power that will then lead into the study of momentum and the conservation of energy. Circular motion and gravitation, translational and rotational equilibrium, fluid mechanics and thermal physics will be covered. The students will study electricity and magnetism then look at waves and optics. A final subject area will be atomic and nuclear physics. Good math skills are critical to success in this course. Prerequisites: Biology I, Algebra I, Geometry, Algebra II or concurrently enrolled.

eoc tech

Course Syllabus

Eastern Oklahoma County
Technology Center
4601 N. Choctaw Rd., Choctaw, OK
390.9591 | www.eoctech.edu

Course Title: *Pre-AP Physics*

Description

This course will cover kinematics in one and two dimensions, as well as forces and vectors. Students will study work, energy, and power that will then lead into the study of momentum and the conservation of energy. Circular motion and gravitation, translational and rotational equilibrium, fluid mechanics and thermal physics will be covered. The students will study electricity and magnetism then look at waves and optics. A final subject area will be atomic and nuclear physics. Good math skills are critical to success in this course.

Text: Physics; Principles and Problems; Holt, (2010)

Instructor
Edward Lord
405-390-5359
elord@eoctech.edu

Course Number OCAS Number	OHLAP Credit	Length	Prerequisites
ST00011 5211	Yes	120 Clock Hours	Algebra I, Geometry, Algebra II or concurrently enrolled in Algebra II

Objectives/Knowledge and Skills:

Objective	National Science Education Standards 9-12 Content Standard	OK C3 Standards
I. Physics Skills		
A. Math Review: Algebra, equations, trig functions, scientific notation, significant figures	A	NA
B. Understand SI Units of Measurement	A	Process & Inquiry 1.3
C. Use common metric prefixes	A	Process & Inquiry 1.3
D. Practice unit conversions	A	NA
E. Recognize linear and direct relationships and interpret the slope of a curve	A	Process & Inquiry 2.3, 6.4
F. Recognize quadratic and inverse relationships	A	Process & Inquiry 2.3, 6.4
G. Be able to graph data points and interpret the graph	A	Process & Inquiry 2.3, 6.4
H. Be able to use dimensional analysis to test validity of an equation	A	NA
I. Define physics and explain its role and scope	A	NA
I. Activities/Labs		
a. Math exercises-worksheets,	A	Process & Inquiry 1.3

games, etc.		
b. Scientific Method/Inquiry Lab	A	Process & Inquiry 1.1, 1.2, 1.3, 3.1, 3.2, 3.3, 3.4, 3.5, 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 6.1, 6.2, 6.3, 6.4
II. Kinematics in One & Two Dimensions		
A. Have an understanding of frame of reference	A	Content- 1.1
B. Understand the difference between distance and displacement and between speed and velocity	A, B	Content- 1.1
C. Be able to interpret and plot position-time graphs	A, B	Content- 1.1
D. Distinguish between average speed and average velocity	A, B	Content- 1.1
E. Understand the concept of instantaneous velocity.	A, B	Content- 1.1
F. Learn to use an organized strategy for solving motion problems	A, B	Content- 1.1
G. Calculate the displacement of an object from the area under a velocity-versus-time curve.	A, B	Content- 1.1
H. Understand what acceleration is and how to solve for it.	A, B	Content- 1.1
I. Be able to solve motion problems in which the acceleration is due to gravity.	A, B	Content- 1.1
J. Determine the acceleration from the curves on a velocity-time graph	A, B	Content- 1.1
K. Use the kinematics equations to solve problems for objects moving at a constant acceleration in a straight line	A, B	Content- 1.1
L. Differentiate between scalar and vector quantities	A, B	Content- 1.1
M. Determine the resultant of two or more vectors using the component method of vector addition	A, B	Content- 1.1
N. Determine the resultant of two or more vectors by graphical method	A, B	Content- 1.1
O. Solve problems involving projectile motion for projectiles fired horizontally and projectiles fired at an angle	A, B	Content- 1.1
P. Understand centripetal acceleration of objects and be able to apply Newton's laws to such motion	A, B	Content- 1.1
Q. Understand simple harmonic motion and it's components	A, B	Content- 1.1
II. Activities & Labs		
a. Create motion graphs	A, B, E	Content- 1.1 Process & Inquiry 1.1, 1.2, 1.3, 2.1, 2.2, 2.3, 5.1, 5.2, 5.3, 6.4
b. Do activities utilizing constant velocity video analysis	A, B, E	Content- 1.1

		Process & Inquiry1.1, 1.2, 1.3, 2.3, 3.1, 3.2, 3.3, 3.4, 3.5, 4.1, 4.2, 4.3, 4.4, 4.5, 4.7, 4.8, 6.3, 6.4
c. Investigate situations with uniformly accelerated motion	A, B, E	Content- 1.1 Process & Inquiry1.1, 1.2, 1.3, 2.3, 3.1, 3.2, 3.3, 3.4, 3.5, 4.1, 4.2, 4.3, 4.4, 4.5, 4.7, 4.8, 6.3, 6.4
d. Determine the range of projectiles	A, B, E	Content- 1.1 Process & Inquiry1.1, 1.2, 1.3, 2.3, 3.1, 3.2, 3.3, 3.4, 3.5, 4.1, 4.2, 4.3, 4.4, 4.5, 4.7, 4.8, 6.3, 6.4
e. Investigate simple harmonic motion by use of a pendulum	A, B, E	Content- 1.1 Process & Inquiry1.1, 1.2, 1.3, 2.3, 3.1, 3.2, 3.3, 3.4, 3.5, 4.1, 4.2, 4.3, 4.4, 4.5, 4.7, 4.8, 6.3, 6.4
III. Forces		
A. Know Newton's Three Laws of Motion and applications of each	A, B, G	Content- 1.1
B. Know what a force is and the four forces that physicists recognize	A, B, G	Content- 1.1, 1.2, 1.3, 1.4
C. Use Newton's Second Law to solve problems	A, B	Content- 1.1
D. Distinguish between weight and mass	A, B	Content- 1.1
E. Demonstrate an understanding of frictional forces and distinguish between static and kinetic	A, B	Content- 1.1
F. Understand net force and be able to calculate the acceleration that results	A, B	Content- 1.1
G. Understand "free fall" and the causes of air resistance and terminal velocity	A, B	Content- 1.1
III. Activities & Labs		
a. Atwood's Machine Labs	A, B, E	Content- 1.1 Process & Inquiry1.1, 1.2, 1.3, 2.3, 3.1, 3.2, 3.3, 3.4, 3.5, 4.1, 4.2, 4.3, 4.4, 4.5, 4.7, 4.8, 6.3, 6.4
b. Friction Labs	A, B, E	Content- 1.1 Process & Inquiry1.1, 1.2, 1.3, 2.3, 3.1, 3.2, 3.3, 3.4, 3.5, 4.1, 4.2, 4.3, 4.4, 4.5, 4.7, 4.8, 6.3, 6.4
c. Labs demonstrating Newton's 1st Law	A, B, E	Content- 1.1 Process & Inquiry1.1, 1.2, 1.3, 2.3, 3.1, 3.2, 3.3, 3.4, 3.5, 4.1, 4.2, 4.3, 4.4, 4.5, 4.7, 4.8, 6.3, 6.4

d. Labs demonstrating Newton's 2^{nd} Law	A, B, E	Content- 1.1 Process & Inquiry1.1, 1.2, 1.3, 2.3, 3.1, 3.2, 3.3, 3.4, 3.5, 4.1, 4.2, 4.3, 4.4, 4.5, 4.7, 4.8, 6.3, 6.4
e. Labs demonstrating Newton's 3^{rd} Law	A, B, E	Content- 1.1 Process & Inquiry 1.1, 1.2, 1.3, 2.3, 3.1, 3.2, 3.3, 3.4, 3.5, 4.1, 4.2, 4.3, 4.4, 4.5, 4.7, 4.8, 6.3, 6.4
IV. Universal Gravitation		
A. List and understand Kepler's Laws	A, B, G	Content- 1.2
B. Be able to calculate periods and velocities of orbiting objects	A, B, D	Content- 1.2
C. Understand Newton's law of gravitational force is proportional to both masses and the inverse square of the distance between the centers of spherical bodies	A, B, G	Content- 1.2
D. Understand the concept of weightlessness	A, B, C	Content- 1.1, 1.2
IV. Activities & Labs		
a. Center of gravity experiments	A, B, C, E	Content- 1.2 Process & Inquiry1.1, 1.2, 1.3, 2.1, 3.1, 3.2, 3.3, 3.4, 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 6.1, 6.2, 6.3, 6.4
b. Plot a planetary orbit, applying Kepler's Laws	A, B, D, E	Content- 1.2 Process & Inquiry 1.3, 5.1, 5.2, 5.3
c. Lab that demonstrates centripetal acceleration and centripetal force of an object in circular motion	A, B, E	Content- 1.2 Process & Inquiry1.1, 1.2, 1.3, 2.1, 3.1, 3.2, 3.3, 3.4, 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 6.1, 6.2, 6.3, 6.4
V. Momentum		
A. Understand the meaning of momentum and impulse	A, B	Content- 2.1
B. Apply conservation of momentum to a variety of problems	A, B	Content- 2.1
C. Distinguish between elastic and inelastic collisions	A, B	Content- 2.1
D. Solve conservation of momentum problems for elastic and inelastic collisions	A, B	Content- 2.1
V. Activities & Labs		
a. Conservation of momentum labs	A, B, E	Content- 2.1 Process & Inquiry1.1, 1.2, 1.3, 2.1, 3.1, 3.2, 3.3, 3.4, 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 6.1, 6.2, 6.3, 6.4

b. Design products to reduce momentum	A, B, E	Content- 2.1 Process & Inquiry1.1, 1.2, 1.3, 2.1, 2.2, 2.3, 3.1, 3.2, 3.3, 3.4, 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 5.1, 5.2, 5.3, 6.1, 6.2, 6.3, 6.4
VI. Work, Energy, & Power		
A. Be able to use the mathematical formulas for work, potential energy, kinetic energy, and power to find the an unknown variable	A, B	Content- 2.1, 2.2
B. Understand the concept of mechanical advantage	A, B	Content- 2.2
C. Be able to calculate kinetic energy and apply the work-energy theorem	A, B	Content- 2.1, 2.2
D. Be able to calculate the gravitational potential energy of a system	A, B	Content- 1.2, 2.1, 2.2
E. Demonstrate an ability to solve problems using the law of conservation of energy	A, B	Content 2.1
VI. Activities & Labs		
a. Conservation of energy labs	A, B, E	Content- 2.1, 2.2 Process & Inquiry1.1, 1.2, 1.3, 2.1, 3.1, 3.2, 3.3, 3.4, 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 6.1, 6.2, 6.3, 6.4
b. Field trips to amusement parks/playgrounds	A, B, E	Content- 2.1, 2.2 Process & Inquiry 1.1, 1.2, 1.3, 2.1, 2.2, 2.3, 4.2, 4.6, 4.7, 4.8, 5.1, 5.2, 5.3, 6.2, 6.3, 6.4
c. Constructing models to demonstrate the conservation of energy in a system	A, B, E	Content- 2.1, 2.2 Process & Inquiry 1.1, 1.2, 1.3, 2.1, 2.2, 2.3, 4.2, 4.6, 4.7, 4.8, 5.1, 5.2, 5.3, 6.2, 6.3, 6.4
VII. Thermal Physics		
A. Understand the nature of thermal energy as explained by the kinetic theory	A, B, F	Content- 2.3
B. Know the difference between thermal energy and temperature and/or heat	A, B	Content- 2.3
C. Understand what specific heat is and be able to calculate heat transfer	A, B	Content- 2.3
D. Describe and use the Celsius and Kelvin temperature scales and be able to convert between them	A, B, G	Content- 2.3
E. Understand and be able to calculate the application of conservation of energy to heat transfers	A, B	Content- 2.1, 2.3
F. Explain the first and second laws	A, B	Content- 2.3

of thermodynamics		
G. Understand the three mechanisms of heat transfer: conduction, convection, and radiation	A, B	Content- 2.3
H. Understand and apply the relationship between pressure, volume, and temperature of an ideal gas.	A, B	Content- 2.3
I. Apply a relationship to determine the ideal efficiency of a heat engine	A, B	Content- 2.3
VII. Activities & Labs		
a. Labs that investigate thermal energy transfer	A, B, E	Content- 2.3 Process & Inquiry1.1, 1.2, 1.3, 2.1, 3.1, 3.2, 3.3, 3.4, 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 6.1, 6.2, 6.3, 6.4
b. Activity that allows observation of the disorder associated with temperature in liquids	A, B, E	Content- 2.3 Process & Inquiry 1.1, 1.2, 1.3, 2.1, 2.2, 2.3, 4.2, 4.6, 4.7, 4.8, 5.1, 5.2, 5.3, 6.2, 6.3, 6.4
VIII. States of Matter		
A. Understand the origin of Pascal's and Archimedes' principles and their applications	A, B, G	Content- 2.3
B. Explain Bernoulli's principle and its applications in producing lift	A, B, G	Content- 2.3
C. Be able to figure the rate of flow of a fluid	A, B	Content- 2.3
D. Have an understanding of the origin of thermal expansion and be able to solve problems using linear thermal expansion. Be able to state some examples of applications and difficulties caused by thermal expansion	A, B	Content- 2.3
E. Describe how cohesive and adhesive forces cause surface tension and capillary action	A, B	Content- 2.3
F. Discuss properties of solids such as elasticity	A, B	Content- 2.1, 2.2, 2.3
VIII. Activities & Labs		
a. Density determination labs	A, B, E	Content- 2.3 Process & Inquiry1.1, 1.2, 1.3, 2.1, 3.1, 3.2, 3.3, 3.4, 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 6.1, 6.2, 6.3, 6.4
b. Investigate the buoyancy of objects	A, B, E	Content- 2.3 Process & Inquiry1.1, 1.2, 1.3, 2.1, 2.2, 2.3, 3.1, 3.2, 3.3, 3.4, 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 6.1, 6.2, 6.3, 6.4

c. Archimedes' principle Demo	A, B, E	Content- 2.3 Process & Inquiry 2.1, 5.1, 5.2, 5.3, 6.4
IX. Electric Force, Potential, and Field		
A. Recognize the basic properties of the electrical interaction	A, B	Content-1.3, 1.4
B. Use Coulomb's law to solve problems related to electrical force	A, B	Content- 1.3
C. Describe the differences between conductors and insulators	A, B	Content- 1.3
D. Know the SI unit of charge and understand the vector nature of the electric force	A, B	Content- 1.3
E. Be able to solve problems related to charge, electric field, and forces	A, B	Content- 1.3
F. Define the electric potential difference in terms of work done moving a unit test charge and distinguish potential from potential difference	A, B	Content- 1.3
G. Know where charges reside on solid and hollow conductors and recognize the relationship between conductor shape and field strength	A, B	Content- 1.3
H. Define capacitance and solve parallel-plate capacitor problems	A, B	Content- 1.3
IX. Activities & Labs		
a. Investigation of static electricity	A, B, E	Content- 1.3 Process & Inquiry1.1, 1.2, 1.3, 2.1, 3.1, 3.2, 3.3, 3.4, 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 6.1, 6.2, 6.3, 6.4
b. Electroscope activities and demo	A, B, E	Content- 1.3 Process & Inquiry 2.1, 5.1, 5.2, 5.3, 6.4
X. Electric Current		
A. Define electric current and the ampere and describe conditions that permit current flow	A, B	Content- 1.3
B. Understand resistance and state Ohm's law	A, B	Content- 1.3
C. Be able to draw circuits and understand energy transfer in them	A, B	Content- 1.3
D. Explain the definition of power in electric circuits and solve problems involving current, potential difference, and power	A, B	Content- 1.3
E. Diagram simple electric circuits and recognize the correct use of ammeters and voltmeters	A, B	Content- 1.3
F. Explain how electric energy is converted into thermal energy	A, B	Content- 1.3, 2.3
G. Describe the use of capacitors for energy storage in circuits	A, B	Content- 1.3
H. Describe series and parallel	A, B	Content- 1.3

circuits and state the important characteristics of each		
I. Define the kilowatt-hour and solve problems involving the use and cost of electrical energy	A, B	Content- 1.3
J. Calculate current, voltage, and equivalent resistance for devices connected in series and in parallel	A, B	Content- 1.3
X. Activities & Labs		
a. Making circuits in series and parallel	A, B, E	Content- 1.3 Process & Inquiry1.1, 1.2, 1.3, 2.1, 2.2, 2.3, 3.1, 3.2, 3.3, 3.4, 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 6.1, 6.2, 6.3, 6.4
b. Circuit analysis	A, B, E	Content- 1.3 Process & Inquiry1.1, 1.2, 1.3, 2.1, 3.1, 3.2, 3.3, 3.4, 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 6.1, 6.2, 6.3, 6.4
c. Drawing electrical schematics	A, B, E	Content- 1.3 Process & Inquiry 2.1, 5.1, 5.2, 5.3, 6.4
d. Design circuits to measure an unknown resistance	A, B, E	Content- 1.3 Process & Inquiry1.1, 1.2, 1.3, 2.1, 3.1, 3.2, 3.3, 3.4, 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 6.1, 6.2, 6.3, 6.4
XI. Magnetism		
A. Learn the origin of magnetism in materials	A, B, G	Content- 1.4, 3.2
B. Describe the magnetic poles and the interactions between magnets	A, B	Content- 3.2
C. Learn the right hand rule to determine the direction of the magnetic field	A, B	Content- 3.2
D. Calculate the magnetic field of a current-carrying wire	A, B	Content- 3.2
E. Calculate the magnetic force on a moving charge	A, B	Content- 3.2
F. Explain the design and operation of an electric motor	A, B	Content- 3.2
XI. Activities & Labs		
a. Magnet exploration experiments	A, B, E	Content- 3.2 Process & Inquiry1.1, 1.2, 1.3, 2.1, 3.1, 3.2, 3.3, 3.4, 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 6.1, 6.2, 6.3, 6.4
b. Magnetic field mapping	A, B, E	Content- 3.2 Process & Inquiry1.1, 1.2, 1.3, 2.1, 2.2, 2.3, 3.1, 3.2, 3.3, 3.4, 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 6.1, 6.2,

		6.3, 6.4
c. Construct and modify an electric motor	A, B, E	Content- 3.2 Process & Inquiry1.1, 1.2, 1.3, 2.1, 3.1, 3.2, 3.3, 3.4, 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 6.1, 6.2, 6.3, 6.4
XII. Electromagnetic Induction		
A. Explain how a changing magnetic field produces an electric current	A, B	Content- 1.4, 3.2
B. Describe how an EMF is produced when there is relative motion between a conductor and a magnetic field	A, B	Content- 3.2
C. Explain how an electric generator works and how it differs from a motor	A, B	Content- 3.2
D. Describe Faraday's experiments and his law of electromagnetic induction	A, B, G	Content- 3.2
E. Explain and apply Lenz's law	A, B,G	Content- 3.2
F. Describe a transformer and solve problems involving voltage, current, and turn ratios	A, B	Content- 3.2
G. Describe the generation of electromagnetic waves by accelerated charges and recognize the use of resonance	A, B	Content- 3.2
H. Know the frequency and wavelength of common electromagnetic waves	A, B	Content- 3.2
XII. Activities & Labs		
a. Build an electromagnet	A, B, E	Content- 3.2 Process & Inquiry1.1, 1.2, 1.3, 2.1, 3.1, 3.2, 3.3, 3.4, 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 6.1, 6.2, 6.3, 6.4
b. Investigate appliances that use electromagnetic waves	A, B, E, F, G	Content- 3.2 Process & Inquiry 1.1, 1.2, 3.1, 3.2, 3.4, 3.5, 4.1, 4.2, 4.4, 4.5, 4.7, 6.1, 6.2, 6.3, 6.4
c. Investigate the basic principles of electromagnetism	A, B, E	Content- 3.2 Process & Inquiry 1.1, 1.2, 3.1, 3.2, 3.4, 3.5, 4.1, 4.2, 4.4, 4.5, 4.7, 6.1, 6.2, 6.3, 6.4
XIII. Waves and Energy Transfer		
A. Distinguish between longitudinal and transverse waves and between a pulse and a continuous wave	A, B	Content- 3.1
B. Know the three terms to describe periodic waves: speed, wavelength, and frequency and solve problems using these quantities	A, B	Content- 3.1

C. Understand that wave speed is dependent on the medium	A, B	Content- 3.1
D. Understand how constructive and destructive interference results	A, B	Content- 3.1
E. Understand the law of reflection and be able to apply it to problem solving	A, B	Content- 3.1
F. Describe refraction and diffraction in term of behavior of a wave	A, B	Content- 3.1
XIII. Activities & Labs		
a. Labs demonstrating wave motion using a Slinky®, string, springs, etc.	A, B, E	Content- 3.1 Process & Inquiry1.1, 1.2, 1.3, 2.1, 3.1, 3.2, 3.3, 3.4, 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 6.1, 6.2, 6.3, 6.4
B. Standing wave demonstrations	A, B, E	Content- 3.1 Process & Inquiry 2.1, 5.1, 5.2, 5.3, 6.4
XIV. Sound		
A. Understand the nature of sound waves	A, B	Content- 3.1
B. Find the speed of sound at different temperatures	A, B	Content- 3.1
C. Apply the Doppler effect to problems involving moving sources of moving observers	A, B	Content- 3.1
D. Show an understanding of resonance as applied to an air column and describe a standing wave. This can be done by solving problems involving standing waves in resonating air columns	A, B	Content- 3.1
XIV. Activities & Labs		
a. Doppler Effect Demonstration Lab	A, B, E	Content- 3.1 Process & Inquiry 2.1, 5.1, 5.2, 5.3, 6.4
b. Labs measuring the speed of sound	A, B, E	Content- 3.1 Process & Inquiry1.1, 1.2, 1.3, 2.1, 2.2, 2.3, 3.1, 3.2, 3.3, 3.4, 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 6.1, 6.2, 6.3, 6.4
c. Making simple wind musical instruments	A, B, E	Content- 3.1 Process & Inquiry 1.1, 1.2, 3.1, 3.2, 3.4, 3.5, 4.1, 4.2, 4.4, 4.5, 4.7, 6.1, 6.2, 6.3, 6.4
d. Demonstration of the construction of a music amplifier	A, B, E	Content- 3.1 Process & Inquiry 2.1, 5.1, 5.2, 5.3, 6.4
XV. Optics		
A. Be able to solve problems	A, B	Content- 3.1

involving the speed of light		
B. Have an understanding of the electromagnetic spectrum and the portion of visible spectrum	A, B	Content- 3.1
C. Define transparent, translucent, and opaque	A, B	Content- 3.1
D. Understand the formation of color in terms of light	A, B	Content- 3.1
E. Describe polarization of light	A, B	Content- 3.1
XV. Activities & Labs		
a. Make a pinhole camera	A, B, E	Content- 3.1 Process & Inquiry1.1, 1.2, 1.3, 2.1, 3.1, 3.2, 3.3, 3.4, 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 6.1, 6.2, 6.3, 6.4
b. Double-Slit Interference Lab	A, B, E	Content- 3.1 Process & Inquiry1.1, 1.2, 1.3, 2.1, 3.1, 3.2, 3.3, 3.4, 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 6.1, 6.2, 6.3, 6.4
c. Chromatography Lab	A, B, E	Content- 3.1 Process & Inquiry1.1, 1.2, 1.3, 2.1, 3.1, 3.2, 3.3, 3.4, 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 6.1, 6.2, 6.3, 6.4
XVI. Geometric Optics		
A. Explain the law of reflection	A, B	Content- 3.1
B. Understand and apply Snell's law	A, B	Content- 3.1
C. Calculate the index of refraction in a medium	A, B	Content- 3.1
D. Explain total internal reflection and define the critical angle	A, B	Content- 3.1
E. Explain how concave and convex mirrors form real and virtual images	A, B	Content- 3.1
F. Distinguish between converging and diverging lenses	A, B	Content- 3.1
G. Describe how real and virtual images are formed by lenses	A, B	Content- 3.1
H. Locate images using ray diagrams and calculate image location and size using equations	A, B	Content- 3.1
I. Calculate image height using the magnification equation	A, B	Content- 3.1
J. Describe Young's double-slit experiment	A, B	Content- 3.1
K. Understand the formation of interference patterns using diffraction gratings	A, B	Content- 3.1
XVI. Activities & Labs		
a. Investigate positions and characteristics of images produced by curved mirrors	A, B, E	Content- 3.1 Process & Inquiry1.1, 1.2, 1.3, 2.1, 3.1, 3.2, 3.3, 3.4, 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 6.1, 6.2, 6.3, 6.4

b. Lab that determines the index of refraction of glass using Snell's law	A, B, E	Content- 3.1 Process & Inquiry1.1, 1.2, 1.3, 2.1, 3.1, 3.2, 3.3, 3.4, 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 6.1, 6.2, 6.3, 6.4
c. Lab that determines the wavelength of a laser light	A, B, E	Content- 3.1 Process & Inquiry1.1, 1.2, 1.3, 2.1, 3.1, 3.2, 3.3, 3.4, 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 6.1, 6.2, 6.3, 6.4
d. Demonstrations of reflection and refraction	A, B, E	Content- 3.1 Process & Inquiry 2.1, 5.1, 5.2, 5.3, 6.4
e. Lab that demonstrates the bending of light	A, B, E	Content- 3.1 Process & Inquiry 1.1, 1.2, 1.3, 2.1, 3.1, 3.2, 3.3, 3.4, 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 6.1, 6.2, 6.3, 6.4
XVII. Atomic and Nuclear Physics		
A. Explain the photoelectric effect	A, B, G	Content- 3.2
B. Describe experiments that demonstrate three particle-like properties of electromagnetic radiation	A, B	Content- 3.2
C. Describe the forms of radioactive decay and solve nuclear equations	A, B	Content- 3.2
D. Define nuclear fission and chain reaction	A, B	Content- 3.2
E. Describe the fusion process	A, B	Content- 3.2
XVII. Activities & Labs		
a. Labs that simulate half-life	A, B, E	Content- 3.2 Process & Inquiry 1.1, 1.2, 1.3, 2.1, 2.2, 2.3, 5.1, 5.2, 5.3, 6.3, 6.4
b. Research on fusion and fission	A, B, E, F, G	Content- 3.2 Process & Inquiry 3.1, 3.5, 5.1, 5.2, 5.3, 6.4
c. Research on medical applications of radioactivity	A, B, E, F, G	Content- 3.2 Process & Inquiry 3.1, 3.5, 5.1, 5.2, 5.3, 6.4

Referenced Standards

National Science Standards (5th ed). (1998). National Research Council, Washington, D.C., National Academy of Sciences

The following grade scale will be used:

A = 100-90
B = 89-80
C = 79-70
D = 69-60
F = 59-below

The student will have one school year to complete this course. Students will participate in class discussion, make presentations, effectively demonstrate physical skills, and pass written tests.

Makeup work policies: *All* work missed due to an ***excused*** absence, including school activity, must be turned in within three (3) school days of the date of absence in order to receive full credit. The student must make arrangements with the instructor, in advance if possible, to schedule make-up work due to an extended absence situation.

Requirements for College Admission Status (Title 70 O.S. § 11-103.6)
These courses are to be taught by a highly qualified teacher with an Oklahoma Physics teaching certification. The students should be in the eleventh or twelfth grade or if a sophomore, they should be in a Focused Field of Career Study program. The course should consist of 40% laboratory or fieldwork in order to be considered a lab science. The course will have at a minimum, but may exceed, a duration of 120 hours within a school year (72 hours theory/48 lab hours).

eoc tech

AP Calculus AB Course Description

Calculus AB is primarily concerned with developing the students' understanding of the concepts of calculus and providing experience with its methods and applications. The course emphasizes a multire presentational approach to calculus, with concepts, results and problems being expressed graphically, numerically, analytically and verbally. The connections among these representations also are important. This course is intended to be challenging and demanding. Broad concepts and widely applicable methods are emphasized. The focus of the course is neither manipulation nor memorization of an extensive taxonomy of functions, curves, theorems or problem types. Thus, although facility with manipulation and computational competence are important outcomes, they are not the core of this course. Technology should be used regularly by students and teachers to reinforce the relationships among the multiple representations of functions, to confirm written work, to implement experimentation, and to assist in interpreting results. Through the use of the unifying themes of derivatives, integrals, limits, approximation, and applications and modeling, the course becomes a cohesive whole rather than a collection of unrelated topics.

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eoc tech

Course Syllabus

Course Title: *AP Calculus AB*

Description: Calculus AB is primarily concerned with developing the students' understanding of the concepts of calculus and providing experience with its methods and applications. The course emphasizes a multirepresentational approach to calculus, with concepts, results and problems being expressed graphically, numerically, analytically and verbally. The connections among these representations also are important. This course is intended to be challenging and demanding. Broad concepts and widely applicable methods are emphasized. The focus of the course is neither manipulation nor memorization of an extensive taxonomy of functions, curves, theorems or problem types. Thus, although facility with manipulation and computational competence are important outcomes, they are not the core of this course. Technology should be used regularly by students and teachers to reinforce the relationships among the multiple representations of functions, to confirm written work, to implement experimentation, and to assist in interpreting results. Through the use of the unifying themes of derivatives, integrals, limits, approximation, and applications and modeling, the course becomes a cohesive whole rather than a collection of unrelated topics.

Text: Finney, Demana, Waits and Kennedy. *Calculus—Graphical, Numerical, Algebraic*. Third edition. Pearson, Prentice Hall, 2007.

This textbook will be our primary resource. You will benefit from reading it. It contains a number of interesting explorations that we will conduct with the goal that you discover fundamental calculus concepts. I will also explain topics in a way that students have found helpful over the years. I encourage cooperative learning, and I believe our entire class benefits from us all working together to help one another construct understanding. My hope is that you want to learn as much as you can about calculus. Mathematicians have been responsible for many great developments throughout history. Much of our understanding of the universe is a direct result of the contributions of mathematicians. Who knows, perhaps we'll discover something during our course of studies. Whatever happens, I hope you learn to view math as more than just numbers, variables, processes, and algorithms. I hope you learn to apply your mathematical understanding to help you create a better understanding of the mathematical nature of our lives.

Instructor
Jana Gaddis
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jgaddis@eoctech.org

Course Number OCAS Code	OHLAP Credit	Length	Prerequisites
ST00061 4615	Yes	120 Clock Hours	Algebra I, Geometry, Algebra II, Trigonometry, Pre-Calculus

Overview: Class meets 45 minutes per day for 175 days.

Objectives/Knowledge and Skills:

Technology Requirement
I will use a Texas Instruments 84 Plus graphing calculator in class regularly. You will want to have a graphing calculator as well. I recommend the TI-84 and the TI-89. I have a classroom set of TI-84 Plus calculators, and some are available for extended checkout from the media center.
We will use the calculator in a variety of ways including:

- Conduct explorations.
- Graph functions within arbitrary windows.
- Solve equations numerically.
- Analyze and interpret results.
- Justify and explain results of graphs and equations.

Course Outline

By successfully completing this course, you will be able to:

- Work with functions represented in a variety of ways and understand the connections among these representations.
- Understand the meaning of the derivative in terms of a rate of change and local linear approximation, and use derivatives to solve a variety of problems.
- Understand the relationship between the derivative and the definite integral.
- Communicate mathematics both orally and in well-written sentences to explain solutions to problems.
- Model a written description of a physical situation with a function, a differential equation, or an integral.
- Use technology to help solve problems, experiment, interpret results, and verify conclusions.
- Determine the reasonableness of solutions, including sign, size, relative accuracy, and units of measurement.
- Develop an appreciation of calculus as a coherent body of knowledge and as a human accomplishment.

A Balanced Approach

Current mathematical education emphasizes a "Rule of Four." There are a variety of ways to approach and solve problems. The four branches of the problem-solving tree of mathematics are:

- Numerical analysis (where data points are known, but not an equation)
- Graphical analysis (where a graph is known, but again, not an equation)
- Analytic/algebraic analysis (traditional equation and variable manipulation)
- Verbal/written methods of representing problems (classic story problems as well as written justification of one's thinking in solving a problem— such as on our state assessment)

Below is an outline of topics along with a tentative timeline. Assessments are given at the end of each unit as well as intermittently during each unit. Semester finals are also given.

Unit 1: Limits and Continuity (3–4 weeks)
A. Rates of Change
1. Average Speed
2. Instantaneous Speed

B. Limits at a Point
1. 1-sided Limits
2. 2-sided Limits
3. Sandwich Theorem
**A Graphical Exploration is used to investigate the Sandwich Theorem. Students graph y1 = x^2, y2 = -x^2, y3 = sin (1/x) in radian mode on graphing calculators. The limit as x approaches 0 of each function is explored in an attempt to "see" the limit as x approaches 0 of x^2 * sin (1/x). This helps tie the graphical implications of the Sandwich Theorem to the analytical applications of it.

C. Limits involving infinity
1. Asymptotic behavior (horizontal and vertical)
2. End behavior models
3. Properties of limits (algebraic analysis)
4. Visualizing limits (graphic analysis)

D. Continuity
1. Continuity at a point
2. Continuous functions
3. Discontinuous functions
a. Removable discontinuity (0/0 form)
**An investigation of the limit as x approaches 1 of f(x) = (x^2 - 7x - 6)/(x - 1) is conducted in small groups. Next, an analytic investigation of the same function is conducted at table groups. Students discuss with their group any conclusions they can draw. Finally, a graphical investigation (using the graphing calculators) is conducted in groups, and then we discuss, as a class, whether the group conclusions are verified or contradicted.
b. Jump discontinuity (We look at y = int(x).)
c. Infinite discontinuity

E. Rates of Change and Tangent Lines
1. Average rate of change
2. Tangent line to a curve
3. Slope of a curve (algebraically and graphically)
4. Normal line to a curve (algebraically and graphically)
5. Instantaneous rate of change

Unit 2: The Derivative (5–6 weeks)

A. Derivative of a Function
1. Definition of the derivative (difference quotient)
2. Derivative at a Point
3. Relationships between the graphs of f and f'
4. Graphing a derivative from data
**A CBL experiment is conducted with students tossing a large ball into the air. Students graph the height of the ball versus the time the ball is in the air. The calculator is used to find a quadratic equation to model the motion of the ball over time. Average velocities are calculated over different time intervals and students are asked to approximate instantaneous velocity. The data and the regression equation are both used in these calculations. These velocities are graphed versus time on the same graph as the height versus time graph.
5. One-sided derivatives

B. Differentiability
1. Cases where f'(x) might fail to exist
2. Local linearity
**An exploration is conducted with the calculator in small groups. Students graph y1 = absolute value of (x) + 1 and y2 = sqrt (x^2 + 0.0001) + 0.99. They investigate the graphs near x = 0 by zooming in repeatedly. The students discuss the local linearity of each graph and whether each function appears to be differentiable at x = 0.
3. Derivatives on the calculator (Numerical derivatives using NDERIV)
4. Symmetric difference quotient
5. Relationship between differentiability and continuity
6. Intermediate Value Theorem for Derivatives

C. Rules for Differentiation
1. Constant, Power, Sum, Difference, Product, Quotient Rules
2. Higher order derivatives

D. Applications of the Derivative
   1. Position, velocity, acceleration, and jerk
   2. Particle motion
   3. L'HÔpital's Rule
   *Although this topic is not on the AP Calculus AB Exam, I believe this allows students to see the connections between derivatives and limits. Also, it provides a useful way to calculate limits both at a point and as x approaches +/- infinity. I believe this adds to the rigor of the course and the preparedness of students for college-level mathematics courses.

   4. Economics
      a. Marginal cost
      b. Marginal revenue
      c. Marginal profit
      *Again, I believe these topics will aid students who choose to matriculate in business in college.

E. Derivatives of trigonometric functions

F. Chain Rule

G. Implicit Differentiation
   1. Differential method
   2. y' method

H. Derivatives of inverse trigonometric functions

I. Derivatives of Exponential and Logarithmic Functions

Unit 3: Applications of the Derivative (5–6 weeks)

A. Extreme Values
   1. Relative Extrema
   2. Absolute Extrema
   3. Extreme Value Theorem
   4. Definition of a critical point

B. Implications of the Derivative
   1. Rolle's Theorem
   2. Mean Value Theorem
   3. Increasing and decreasing functions

C. Connecting f' and f'' with the graph of f(x)
   1. First derivative test for relative max/min
   2. Second derivative
      a. Concavity
      b. Inflection points
      c. Second derivative test for relative max/min

D. Optimization problems

E. Linearization models
   1. Local linearization
      **An exploration using the graphing calculator is conducted in small groups where students graph f(x) = (x^2 + 0.0001)^0.25 + 0.9 around x = 0. Students algebraically find the equation of the line tangent to f(x) at x = 0. Students then repeatedly zoom in on the graph of f(x) at x = 0. Students are then asked to approximate f(0.1) using the tangent line and then calculate f(0.1) using the calculator. This is repeated for the same function, but different x values further and further away from x = 0. Students then individually write about and then discuss with their group the use of the tangent line in approximating the value of the function near (and not so near) x = 0.
   2. Tangent line approximation
   3. Differentials

F. Related Rates

Unit 4: The Definite Integral (3–4 weeks)

A. Approximating areas
1. Riemann sums
   a. Left sums
   b. Right sums
   c. Midpoint sums
   d. Trapezoidal sums
   **Here students are asked to input a program that will calculate trapezoidal sums for trapezoids of equal width. They are given this program. They are encouraged to think about altering it to be able to calculate rectangular sums as well.
2. Definite integrals
   **Students are asked to graph, by hand, a constant function of their choosing. Then they are asked to calculate a definite integral from x = -3 to x = 5 using known geometric methods. Students then share their work with their group and are asked to come up with a group observation. Those observations are shared with other groups and a formula is discovered.

B. Properties of Definite Integrals
1. Power rule
2. Mean value theorem for definite integrals
   **An exploration is conducted to show students the geometry of the mean value theorem for definite integrals and how it is connected to the algebra of the theorem.

C. The Fundamental Theorem of Calculus
1. Part 1
2. Part 2

Unit 5: Differential Equations and Mathematical Modeling (4 weeks)

A. Slope Fields

B. Antiderivatives
1. Indefinite integrals
2. Power formulas
3. Trigonometric formulas
4. Exponential and Logarithmic formulas

C. Separable Differential Equations
1. Growth and decay
2. Slope fields (Resources from the AP Calculus website are liberally used.)
3. General differential equations
4. Newton’s law of cooling

D. Logistic Growth

Unit 6: Applications of Definite Integrals (3 weeks)

A. Integral as net change
1. Calculating distance traveled (particle motion)
2. Consumption over time
3. Net change from data

B. Area between curves
1. Area between a curve and an axis
   a. Integrating with respect to x
   b. Integrating with respect to y
2. Area between intersecting curves
   a. Integrating with respect to x
   b. Integrating with respect to y

C. Calculating volume
  1. Cross sections
  2. Disc method
  3. Shell method

Unit 7: Review/Test Preparation (time varies, generally 3–5weeks)

A. Multiple-choice practice (Items from past exams are used.)
  1. Test taking strategies are emphasized
  2. Individual and group practice are both used

B. Free-response practice (Released items from the AP Central website are used liberally.)
  1. Rubrics are reviewed so students see the need for complete answers
  2. Students collaborate to formulate team responses
  3. Individually written responses are crafted. Attention to full explanations is emphasized

Unit 8: After the exam…

A. Projects designed to incorporate this year's learning in applied ways

B. Research projects on the historical development of mathematics with a focus on calculus

C. Advanced integration techniques

D. A look at college math requirements and expectations including placement exams

Referenced Standards

Principles and Standards for School Mathematics (4th ed.). (2005). National Council of Teachers of Mathematics, Reston, VA

All AP Courses undergo an AP Course Audit through College Board. Please refer to their website for further information.
http://apcentral.collegeboard.com

The following grade scale will be used:

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C = 79-70
D = 69-60
F = 59-below

The student will have one school year to complete this course. Students will participate in class discussion, make presentations, effectively demonstrate physical skills, and pass written tests.

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eoc tech

Course Syllabus

Course Title: *AP Calculus BC*

Description: Calculus pulls together many of the concepts students have studied in previous courses, and it also helps them to see the relevance of the material they were taught prior to calculus. I believe that AP® Calculus BC gives the students a strong foundation for the math and science courses they will take in college.

Course Planner

First Semester

Chapter 1: Limits and Their Properties (10 days—one test)

- Lab on limits
- An introduction to limits, including an intuitive understanding of the limit process
- Using graphs and tables of data to determine limits
- Properties of limits
- Algebraic techniques for evaluating limits
- Comparing relative magnitudes of functions and their rates of change
- Continuity and one-sided limits
- Geometric understanding of the graphs of continuous functions
- Intermediate Value Theorem
- Infinite limits
- Using limits to find the asymptotes of a function

Chapter 2: Differentiation (19 days—two tests)

- Zooming-in activity and local linearity
- Understanding of the derivative: graphically, numerically, and analytically
- Approximating rates of change from graphs and tables of data
- The derivative as: the limit of the average rate of change, an instantaneous rate of change, limit of the difference quotient, and the slope of a curve at a point
- The meaning of the derivative—translating verbal descriptions into equations and vice versa
- The relationship between differentiability and continuity
- Functions that have a vertical tangent at a point
- Functions that have a point on which there is no tangent
- Differentiation rules for basic functions, including power functions and trigonometric functions
- Rules of differentiation for sums, differences, products, and quotients
- The chain rule
- Implicit differentiation
- Related rates

Chapter 3: Applications of Differentiation (19 days—two tests)

- Extrema on an interval and the Extreme Value Theorem
- Rolle's Theorem and the Mean Value Theorem, and their geometric consequences
- Lab on the First Derivative Test
- Increasing and decreasing functions and the First Derivative Test
- Lab on concavity and points of inflection
- Concavity and its relationship to the first and second derivatives
- Second Derivative Test
- Limits at infinity
- A summary of curve sketching—using geometric and analytic information as well
as calculus to predict the behavior of a function
- Relating the graphs of f, f', and f''
- Optimization including both relative and absolute extrema
- Tangent line to a curve and linear approximations
- Application problems including position, velocity, acceleration, and rectilinear motion

Chapter 4: Integration (15 days—two tests)
- Antiderivatives and indefinite integration, including antiderivatives
following directly
from derivatives of basic functions
- Basic properties of the definite integral
- Area under a curve
- Meaning of the definite integral
- Definite integral as a limit of Riemann sums
- Riemann sums, including left, right, and midpoint sums
- Trapezoidal sums
- Use of Riemann sums and trapezoidal sums to approximate definite
integrals of functions that are represented analytically, graphically, and by tables of data
- Discovery lesson on the First Fundamental Theorem of Calculus
- Use of the First Fundamental Theorem to evaluate definite integrals
- Use of substitution of variables to evaluate definite integrals
- Integration by substitution
- Discovery lesson on the Second Fundamental Theorem of Calculus
- The Second Fundamental Theorem of Calculus and functions defined by integrals
- The Mean Value Theorem for Integrals and the average value of a function

Chapter 5: Logarithmic, Exponential, and Other
Transcendental Functions (16 days—two tests)
- The natural logarithmic function and differentiation
- The natural logarithmic function and integration
- Inverse functions
- Exponential functions: differentiation and integration
- Bases other than *e* and applications
- Solving separable differential equations
- Applications of differential equations in modeling, including exponential growth
- Use of slope fields to interpret a differential equation geometrically
- Drawing slope fields and solution curves for differential equations
- Euler's method as a numerical solution of a differential equation

First Semester Exam (two review days)

Second Semester

Chapter 5: Logarithmic, Exponential, and Other Transcendental Functions (4 days—one test)

- Inverse trig functions and differentiation
- Inverse trig functions and integration

Chapter 6: Applications of Integration (10 days—one test)

- The integral as an accumulator of rates of change
- Area of a region between two curves
- Volume of a solid with known cross sections
- Volume of solids of revolution
- Arc length
- Applications of integration in physical, biological, and economic contexts
- Applications of integration in problems involving a particle moving along a line, including the use of the definite integral with an initial condition and using the definite integral to find the distance traveled by a particle along a line

Chapter 7: Integration Techniques, L'Hôpital's Rule, and Improper Integrals (17 days—two tests)

- Review of basic integration rules
- Integration by parts
- Trigonometric integrals
- Integration by partial fractions
- Solving logistic differential equations and using them in modeling
- Discovery lab on L'Hôpital's Rule
- L'Hôpital's Rule and its use in determining limits
- Discovery activity on improper integrals
- Improper integrals and their convergence and divergence, including the use of L'Hôpital's Rule

Chapter 8: Infinite Series (17 days—two tests)

- Lab on Sequences
- Convergence and divergence of sequences
- Definition of a series as a sequence of partial sums
- Convergence of a series defined in terms of the limit of the sequence of partial sums of a series
- Introduction to convergence and divergence of a series by using technology on two examples to gain an intuitive understanding of the meaning of convergence
- Geometric series and applications
- The nth-Term Test for Divergence
- The Integral Test and its relationship to improper integrals and areas of rectangles
- Use of the Integral Test to introduce the test for p-series
- Comparisons of series
- Alternating series and the Alternating Series Remainder
- The Ratio and Root Tests
- Taylor polynomials and approximations: introduction using the graphing calculator
- Power series and radius and interval of convergence
- Taylor and Maclaurin series for a given function
- Maclaurin series for $\sin x$, $\cos x$, ex, and $\frac{1}{1-x}$
- Manipulation of series, including substitution, addition of series, multiplication of series by a constant and/or a variable, differentiation of series, integration of series, and forming a new series from a known series
- Taylor's Theorem with the Lagrange Form of the Remainder (Lagrange Error Bound)

Chapter 10: Plane Curves, Parametric Equations, and Polar Curves (12 days—one test)

- Plane curves and parametric equations
- Parametric equations and calculus
- Parametric equations and vectors: motion along a curve, position, velocity, acceleration, speed, distance traveled
- Analysis of curves given in parametric and vector form
- Polar coordinates and polar graphs
- Analysis of curves given in polar form
- Area of a region bounded by polar curves

After the AP Exam:

Chapter 16: Differential Equations (6 days—one test)

- Definitions and basic concepts of differential equations
- First-order linear differential equations
- Second-order homogeneous linear equation

Chapter 5: Hyperbolic Functions (4 days—one test)

- Hyperbolic functions and applications

Second Semester Exam (two review days)

Teaching Strategies

Learning by Discovery

I introduce each unit with a discovery lesson. I think that exploration and discovery are great ways for students to learn, because these methods help students have more ownership in the material being covered than they would using a traditional lecture approach. The discovery lessons are done in groups of two or three students.

Graphing Calculator

Many of the discovery lessons rely heavily on the use of the graphing calculator. The calculator helps students develop a visual understanding of the material that they would not otherwise have. My students use the TI-89 graphing calculator almost every day in class for explorations and in assignments to analyze functions and justify solutions. For example, the students use the calculator to approximate the values of derivatives and definite integrals obtained through analytical means in order to verify that the answers are reasonable.

However, many homework problems and about half of the problems on quizzes and tests are done without the use of the graphing calculator. Since the AP Exam is half calculator and half noncalculator, I feel that it is very important for students to have practice working problems both ways. We spend time in class discussions talking about the types of questions that they must know how to work *with* their calculators and the types of questions that they must know how to work *without* their calculators. We also discuss the techniques needed to use the calculator most efficiently (storing functions in the y = screen, storing values that will be used later in the problem, etc.).

Rule of Four

I give my students many opportunities to work problems presented in a variety of ways: graphical, numerical, analytical, and verbal. Most of the problems in my primary textbook are written with an analytical representation, so I frequently supplement these problems with ones that utilize a graph or tabular data. I also often ask students for verbal explanations to give them the opportunity to communicate their reasoning in words.

Justification of Answers

I ask my students to justify their answers on homework, quizzes, and tests, and I prefer that they write the justifications in sentences. We talk a lot about the amount of work they need to show and the correct way to justify their work on various types of problems. (The "Commentary on the Instructions for the Free-Response Section of the AP Calculus Exams" on AP Central® is very helpful in showing examples of correct justifications.)

AP Review

I try to allot a minimum of three weeks before the AP Exam to devote to review. During this three-week period, students work on the sample questions in the *AP Calculus Course Description* and on multiple-choice and free-response questions from AP Released Exams. Some of these are assigned for homework, while others are given as a quiz or test.

Primary Textbook

Larson, Ron, Robert P. Hostetler, and Bruce H. Edwards. *Calculus with Analytic Geometry*. 5th ed. Boston: Houghton Mifflin, 1994.

AP Physics B Course Description

The Physics B course includes topics in both classical and modern physics. A knowledge of algebra and basic trigonometry is required for the course; the basic ideas of calculus may be introduced in connection with physical concepts, such as acceleration and work. Understanding of the basic principles involved and the ability to apply these principles in the solution of problems should be the major goals of the course. Consequently, the course utilizes guided inquiry and student-centered learning to foster the development of critical thinking skills.

Physics B should provide instruction in each of the following five content areas: Newtonian mechanics, fluid mechanics and thermal physics, electricity and magnetism, waves and optics, and atomic and nuclear physics.

The Physics B course includes a hands-on laboratory component comparable to introductory college-level physics laboratories, with a minimum of 12 student-conducted laboratory investigations representing a variety of topics covered in the course. Each student will complete a lab notebook or portfolio of lab reports.

Course Title: *AP Physics B*

Description: AP Physics is intended to be a rigorous course that is on the level of most college physics courses. AP Physics B has a trigonometry emphasis. Five major content areas of physics will be taught. They are: mechanics, thermodynamics, waves and optics, electricity & magnetism, and modern physics. Students will be expected to sit for the AP exam at the completion of the course.

Text: Giancoli, D. (2009) *Physics: Principles with Applications, 6th* rev. ed. Upper Saddle River, NJ: Pearson Prentice Hall. ISBN 0-13-1362271

Giancoli, D. (2004) *Preparing for the AP Physics B Examination with Giancoli: Physics*. Upper Saddle River, NJ. Pearson Prentice Hall. ISBN 0-536-73158-6

AP Physics Lab Manual ISBN: 0130611468

Instructor
Edward Lord
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Course Number OCAS Code	OHLAP Credit	Length	Prerequisites
ST00063 5215	Yes	120 Clock Hours	Biology I, Algebra I, Geometry, Algebra II, Trigonometry

Overview: Class meets 45 minutes per day for 175 days with flex time allowed one day each week for labs. Flex time extends the class time to 90 minutes. Classes begin in mid August and end in early May. Students are required to work in groups to encourage peer-teaching and peer-review. All students are required to keep a lab portfolio, perform experiments, interpret the results of observations and communicate results, including uncertainty assessment. Students are encouraged to read, understand, and interpret physical information and use the scientific method to analyze a particular phenomenon or problem. They will use basic mathematical reasoning to solve a physical situation or problem.

Objectives/Knowledge and Skills:

Review: (1 week)
- A. Algebra review
- B. Data collection and analysis methods
- C. Vector addition
  1. Graphical methods
  2. Algebraic methods

I. Newtonian Mechanics (13 Weeks)
- A. Kinematics (including vectors, vector algebra, components of vectors, coordinate systems, displacement, velocity, and acceleration)
  1. Motion in one dimension
  2. Motion in two dimensions, including projectile motion
- B. Newton's laws of motion
  1. Static equilibrium (first law)
  2. Dynamics of a single particle (second law)
  3. Systems of two or more objects (third law)
- C. Work, energy, power
  1. Work and work–energy theorem
  2. Forces and potential energy
  3. Conservation of energy
  4. Power

D. Systems of particles, linear momentum
   1. Center of mass
   2. Impulse and momentum
   3. Conservation of linear momentum, collisions

E. Circular motion and rotation
   1. Uniform circular motion
   2. Torque and rotational statics
   3. Rotational kinematics and dynamics
   4. Angular momentum and its conservation

F. Oscillations and gravitation
   1. Simple harmonic motion (dynamics and energy relationships)
   2. Mass on a spring
   3. Pendulum and other oscillations
   4. Newton's law of gravity
   5. Orbits of planets and satellites
      a. Circular
      b. General

II. Fluid Mechanics and Thermal Physics (5 Weeks)

A. Fluid Mechanics
   1. Hydrostatic pressure
   2. Buoyancy
   3. Fluid flow continuity
   4. Bernoulli's equation

B. Temperature and heat
   1. Mechanical equivalent of heat
   2. Heat transfer and thermal expansion

C. Kinetic theory and thermodynamics
   1. Ideal gases
      a. Kinetic model
      b. Ideal gas law
   2. Laws of thermodynamics
      a. First law (including processes on pV diagrams)
      b. Second law (including heat engines)

III. Electricity and Magnetism (9 Weeks)

A. Electrostatics
   1. Charge and Coulomb's law
   2. Electric field and electric potential (including point charges)
   3. Gauss's law
   4. Fields and potentials of other charge distributions

B. Conductors, capacitors, dielectrics
   1. Electrostatics with conductors
   2. Capacitors
      a. Capacitance
      b. Parallel plate
      c. Spherical and cylindrical
   3. Dielectrics

C. Electric circuits
   1. Current, resistance, power
   2. Steady-state direct current circuits with batteries and resistors only
   3. Capacitors in circuits
      a. Steady state
      b. Transients in RC circuits

D. Magnetic Fields
   1. Forces on moving charges in magnetic fields
   2. Forces on current-carrying wires in magnetic fields
   3. Fields of long current-carrying wires
   4. Biot–Savart law and Ampere's law

E. Electromagnetism
   1. Electromagnetic induction (including Faraday's law and Lenz's law)

2. Inductance (including LR and LC circuits)
3. Maxwell's equations

IV. Waves and Optics (5 Weeks)
A. Wave motion (including sound)
1. Traveling waves
2. Wave propagation
3. Standing waves
4. Superposition
B. Physical optics
1. Interference and diffraction
2. Dispersion of light and the electromagnetic spectrum
C. Geometric optics
1. Reflection and refraction
2. Mirrors
3. Lenses

V. Atomic and Nuclear Physics (2 Weeks)
A. Atomic physics and quantum effects
1. Photons, the photoelectric effect, Compton scattering, x-rays
2. Atomic energy levels
3. Wave-particle duality
B. Nuclear physics
1. Nuclear reactions (including conservation of mass number and charge)
2. Mass–energy equivalence

Labs: (90 Minutes per lab for data collection. Analysis and write up are homework.)

Most labs are open ended. Students are given a set of materials and an objective and then they have to solve the problem. Students are required to create data tables and graphs by hand. Formal lab reports must include a statement of problem, a hypothesis, procedure, data table, analysis, conclusion including error analysis, and topics for further study. Each student is required to turn in a formal lab report. Labs are conducted in teams of two students. All labs are student hands on labs.

List of laboratory topics:

1. Acceleration due to gravity
2. Determining the speed and direction of a projectile
3. Determine an unknown mass using an Atwood's machine
4. Determine the coefficient of static friction
5. Determine your personal power output
6. Determine the force constant of a spring
7. Determine the density of an unknown material
8. Determine the specific heat of an unknown material
9. Investigation and discovery with the Van de Graaff generator
10. Mapping an electric field
11. Verify Ohm's Law using DC electric circuits
12. Determine the speed of sound
13. Determine the linear mass density of a string
14. Determine the index of refraction of a lens
15. Investigate the relationship of wavelength and slit separation (interference of light)
16. Determine the wavelength of a laser using two-slit interference
17. Determine Planck's constant

Referenced Standards

National Science Standards (5th ed). (1998). National Research Council, Washington, D.C., National Academy of Sciences

Oklahoma Priority Academic Student Skills (2003). Oklahoma State Department of Education-PASS-{ www.sde.state.ok.us}

All AP Courses undergo an AP Course Audit through College Board. Please refer to their website for further information.

http://apcentral.collegeboard.com

The following grade scale will be used:

A = 100-90
B = 89-80
C = 79-70
D = 69-60
F = 59-below

The student will have one school year to complete this course. Students will participate in class discussion, make presentations, effectively demonstrate physical skills, and pass written tests.

Makeup work policies: *All* work missed due to an ***excused*** absence, including school activity, must be turned in within three (3) school days of the date of absence in order to receive full credit. The student must make arrangements with the instructor, in advance if possible, to schedule make-up work due to an extended absence situation.

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Course Syllabus

Course Title: *AP Chemistry*

Description: Our school offers two sections of AP Chemistry, which meet five days a week for 55 minutes; two periods per week for laboratories.

Teaching Strategies

I use the following strategies when teaching my AP Chemistry course. I believe they are the most important factors to having a successful course.

1. **Create a group spirit** and high *esprit de corps*, similar to that which develops among members of a sports team.

2. **Encourage students to work together in order to learn.** The class is not split into "those who are" and "those who are not" going to take the AP Exam; everyone is in the same boat. Since every student realizes that he or she is going to take the exam, each works hard to understand the material.

3. **Limit lectures to allow plenty of time for other learning activities.** I do not lecture a great deal. After students have read and outlined a chapter, I will spend a day or two lecturing on it, covering the high points of the theory, deriving any important equations, and presenting demonstrations that are relevant to the topic. I assign a few questions from the back of each chapter but use them only as an introduction to the material. We go over these questions, and shortly thereafter I hand out a set of questions taken from AP Released Exams. These are the essay and problem-type questions that students can expect to see on the exam in May.

4. **Keep quizzes and tests short,** sometimes even to just one or two questions, so that testing does not take up too much time during the class period.

5. **Require each student to present the solution to a problem.** This technique is probably my trademark as a teacher. Each student receives 6 to 10 AP Released Exam questions/problems on the current chapter and is expected to complete them in two or three days. (The problems often do not contain all the parts of the original exam question; for example, I only assign those parts that pertain to the chapter we are covering.) In addition, each student is responsible for presenting two of the questions/problems on the overhead projector for the entire class. Many students receive the same question, but they do not know who will be asked to do the presentation. Students receive points based on the quality of their presentation. I post the detailed solution to each problem in the classroom so they can examine beforehand the problems they do not understand.

Students often have stage fright when they are first asked to present the solution. They soon find, however, that the rest of the class wants them to succeed. The class is attentive during the explanation and even tries to help the presenter over the rough spots. My role as the teacher is to stand near the back of the room and oversee the process. This involves knowing when to step in and ask pertinent and probing questions such as, “Could you go over step three again? I don’t understand how you got your answer.” I will ask the presenter questions if I feel the class is getting lost. I can tell when this happens because the class usually grows very quiet, as if projecting the plea, “Don’t call on me because I don’t understand.” There are also times when I ask questions because I honestly cannot follow what the presenter is doing.

The seminar-like atmosphere these problem-presentation sessions create is not threatening and makes it easy for students to ask questions. Soon there is a lively give-and-take between the presenter and the class. Lights seem to go on and learning takes place. These sessions are the very heart of how I teach AP Chemistry.

Preparing for the AP Chemistry Exam

Three weeks before the AP Exam I schedule six review sessions from 7:30 to 9:00 p.m. in my classroom to go over multiple-choice questions from the 1994 AP Exam. Two Saturdays before the exam we all meet in the school cafeteria in the morning to take the 1989 AP Exam for practice. The following Saturday the same procedure is followed with the 1994 AP Exam. The exams are identical in administration to the actual AP Exam. At the end of both exams I give the answers and a scoring sheet to the students, which they use to grade their own exams and figure their scores. They are shocked by their results on the first exam but are better able to see the areas in which they are weak. The second exam usually shows an improvement in scores since students know where to focus their preparation.

Laboratory

Students are required to submit a complete report for each lab experiment, including a hypothesis, procedure, observations/data, calculations, and a conclusion. All reports are kept in a lab notebook. Very often students are called upon to make a presentation to the class about their hypotheses, calculations, and conclusions in a similar manner to the questions/problems-solving method described above. In this way, students are able to collaborate on the objectives and design of an experiment, to assist each other in reaching conclusions, and to gain insights into variance and sources of error.

Texts

McQuarrie, Donald A., and Peter A. Rock. *General Chemistry.* 3rd ed. Zumdahl, Steven. *Chemistry.* 3rd ed.

Laboratory Manuals

We do not use a lab manual but rather a collection of labs from various sources.
These include:

Hope College Lab Program. Hope College, Holland, Mich.
Masterson, William L., and Emil J. Slowinski. *Chemical Principles in the Laboratory.* 5th ed.
Ehrenkranz, David and John J. Mauch. *Chemistry in Microscale.*

Demonstration Resources

Shakhashiri, Bassam. *Chemical Demonstrations: A Handbook for Teachers of Chemistry.*
Summerlin, Lee R., and James L. Ealy, Jr. *Chemical Demonstrations: A Sourcebook for Teachers*

Course Outline

Note: An asterisk (*) indicates the most important labs.

Unit I: Calculations and Uncertainty .... 1.0 weeks

Dimensional analysis, uncertainty, significant figures.

Suggested Experiments

• None

Unit 2: Atoms, Molecules, and Ions................................ 1.5 weeks
Review of formula writing, oxidation states, nomenclature, etc.

Suggested Experiments

çSafety in the lab
• How to use a balance
• How to use equipment

Unit 3: Stoichiometry.. 2.5 weeks
Mole, atomic weight, molecular formula, balancing equations, limiters, empirical formulas, percent composition, percent yield, and solution stoichiometry.

Suggested Experiments

• Empirical formula of copper iodide (Hope College)*
• Synthesis of aspirin (Masterton)
• Net ionic reactions using microscale (Mauch)*

Unit 4: Gases.. 2.0 weeks
Ideal gas law, van der Waal's equation, Avogadro's Law, STP, Dalton's Law, Graham's Law, kinetic theory of gases, etc.

Suggested Experiments

• Molecular mass of a volatile liquid (Masterton)* Isopropanol works best.

Unit 5: Thermochemistry... 2.0 weeks
Enthalpy, thermochemical equations, heats of formation, bond energies, heats of reactions, etc.

Suggested Experiment

• Calorimetry (Hope College)*

This covers thermochemistry and solution stoichiometry.

Unit 6: Atomic Structure and Periodicity...................... 2.0 weeks
Atomic spectra, Bohr atom, quantum numbers, atomic orbitals, electron configurations, periodic table, trends in the periodic table in terms of physical and chemical properties.

Suggested Experiments

• Flame test for metals using spectroscopes

[Also, show discharge tubes and how they relate to wavelength. Mention bright line spectra and have students use diffraction gratings to view spectra.]

Unit 7: Chemical Bonding.. 3.0 weeks
Lewis structures, ionic bonding, character of bonds, covalent model, octet rule and exceptions, resonance, VSEPR model, and hybridization.

Suggested Experiment

• VSEPR model building using styrofoam balls and pipe cleaners.*

Students must first make five geometries and be able to distinguish between electron and molecular geometry. It is important that students know this material well for the AP Exam.

Unit 8: Liquids and Solids.. 1.5 weeks
Dipole–dipole interactions, hydrogen bonding, London forces, liquid state, types of solids, metallic bonding, network solids, vapor pressure, change of state, phase diagrams, and specific heat.

Suggested Experiment

- None

There are many good demonstrations for this unit's material.

Unit 9: Properties of Solutions....................................... 2.0 weeks
Electrolytes and nonelectrolytes, molarity, molality, mole fraction, colligative properties, Raoult's Law, Henry's law, freezing point depression, boiling point elevation, and osmotic pressure.

Suggested Experiment

- Molecular mass determination by freezing point depression (Masterton)

[There are also many good demonstrations for this unit.]

Unit 10: Chemical Thermodynamics.............................. 2.5 weeks
Gibbs free energy equation, laws of thermodynamics, enthalpy, entropy, free energy, energy and work, exothermic and endothermic reactions, and state functions.

Suggested Experiments

- None

There are many good demonstrations from a variety of sources for this unit.

Unit 11: Chemical Kinetics.. 2.5 weeks
Reaction kinetics, rate law expressions, order of reactions, rate constant, half-life, activation energy, catalysts, and reaction mechanism.

Suggested Experiment

- Kinetics of thiosulfate decomposition (Ehrenkranz)

Unit 12: Chemical Equilibria .... 2.0 weeks
Laws of mass action, equilibrium expressions, calculations of K and equilibrium concentrations, Le Chatelier's principle, and how equilibrium is shifted by temperature, concentration, etc.

Suggested Experiment

- Determination of the equilibrium constant (Hope College)

Unit 13: Acids and Bases .... 2.5 weeks
pH, Ka and Kb expressions, titration, degree of ionization, Kw expressions, indicators, equivalence points, Arrhenius, Brønsted-Lowry and Lewis acid theories, and salt hydrolysis.

Suggested Experiments

- Titration of a solid acid to find its molecular weight (Hope College)
- Titration of a diprotic acid (Hope College)*

Unit 14: Electrochemistry .... 1.5 weeks
Oxidation and reduction half-cells and equations, electrochemical (voltaic) cells, standard voltages, standard voltages from a table, Nernst equation, Faraday's laws, writing redox equations, and balancing equations in acid/base solutions.

Suggested Experiment

- Electrolysis of water, identifying electrodes, writing half reactions, etc.* This is a lab I created. It uses a nine-volt battery, two pencils sharpened on both ends, and universal solution in water and shows the evolution of hydrogen and oxygen and the ensuing color changes. Students must write the half reactions and the overall reaction and justify each step.

Unit 15: Nuclear Chemistry...0.5 week
This unit takes only a few days and includes nuclear equations, half lives, nuclear particle emissions, fission and fusion, and a bit about nuclear reactors.

AP Exam Review...3.0 to 4.0 weeks
I emphasize writing net ionic equations, knowing the solubility rules, solving equilibrium problems, and reviewing AP Released Exams.

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Course Syllabus

Course Title: *AP Environmental Science*

Description: The goal of this course is to provide students with the scientific principles, concepts, and methodologies to understand the interrelationships of the natural world, to identify and analyze environmental problems both natural and human-made, and to evaluate the risks associated with these problems and examine alternative solutions for resolving and/or preventing them.

Text: Living in the Environment, 12th ed., by G. Tyler Miller, Brooks/Cole, Cengage Learning, 2000.

Methods: Instruction consists mostly of lectures, discussions, demonstrations, and written assignments—including research projects, in-class assignments, and homework. A minimum of one period per week is devoted to hands-on laboratory experiences or fieldwork. All lab and fieldwork requires a written report.

Scoring Components		**Page(s)**
SC1	The course provides instruction in Earth Systems	6
SC2	The course provides instruction in Earth Resources	8
SC3	The course provides instruction in the Living World	2
SC4	The course provides instruction in Population	3
SC5	The course provides instruction in Land Use	4
SC6	The course provides instruction in Water Use	6
SC7	The course provides instruction in Energy Resources	8
SC8	The course provides instruction in Energy Consumption	8
SC9	The course provides instruction in Pollution	6
SC10	The course provides instruction in Global Change	9
SC11	The course provides students with scientific principles required to understand the interrelationships of the natural world and draws upon various scientific disciplines.	1
SC12	The course includes methods for analyzing and interpreting information	2
SC13	The course includes methods for analyzing and interpreting experimental data	3
SC14	The course includes methods for analyzing and interpreting mathematical calculations	1
SC15	The course teaches students how to identify and analyze environmental problems	4
SC16	The course teaches students how to critically examine various solutions for resolving or preventing environmental problems by evaluating the associated ecological risks and human health risks.	10
SC17	The course includes a laboratory and/or field investigation component. A minimum of one class period, or its equivalent, per week is spent engaged in laboratory and/or fieldwork.	1

Unit 1: Introduction and Basic Concepts in Environmental Science

Chapter 1

Topic: Environmental Problems, Their Causes and Sustainability

General overview of the topics covered throughout the year

- Lab: Exponential Growth—A Toss of the Dice: Using random throws of dice, this activity simulates population growth of a species. Factors such as life span, birthrate, resource depletion, and population momentum are explored. Probability, and statistics are introduced to the study of ecology
- Video: *The Lorax*

Chapter 2

Topic: Environmental History

A. How humans have adapted to and modified the environment

B. Environmental history of the United States

- Lab: Let's Go Fishing—Mark/Recapture Activity: Students sample, mark, and resample in order to use the Petersen Method to determine the fish population in a pond.
- Internet Activity: Top Environmental Stories, 1970-2000
- Video: *Race to Save the Planet: The Environmental Revolution*

Test: Chapters 1 and 2

Unit 2: Science, Systems, Matter and Energy

Chapter 3

Topic: Science Systems, Matter, and Energy

A. The scientific method

B. Nature's building blocks—a review of general chemistry

C. Different forms of energy and their importance in environmental science

D. Laws of matter and energy

- Lab: Effects of Radiation on Seed Germination and Growth— Students measure, over a series of days, the effects of three types of radiation on the germination and subsequent growth of the irradiated seeds. They then treat their data to statistical analysis in order to draw conclusions.

Unit 3: Living World

Chapter 4

Topic: Ecosystems: Components, Energy Flow, and Matter Cycling

A. Populations, communities, food chains, and webs

B. Ecological pyramids and productivity

C. Biogeochemical cycles

- Lab: What's in an Owl Pellet? Students gain insight into the habits and adaptations (such as sources and preferences of prey) of an apex predator by examining owl pellets.

Test: Chapters 3 and 4

Chapter 5

Topic: Evolution and Biodiversity: Origins, Niches, and Adaptation

A. Micro- and macroevolution

B. Niches—fundamental and realized, generalists and specialists

C. Theories and misconceptions about evolution

- Lab: Biodiversity in Leaf Litter: A Berlese funnel is used to collect organisms from leaf litter. Biodiversity is calculated using the Shannon-Weiner Diversity Index.

Chapter 6

Topic: Biogeography, Climate, Biomes, and Terrestrial Biodiversity

A. Weather and climate

B. What are biomes and how do they differ?

- Internet Activity: Creating and Understanding Climatograms
- Project: Biomes
- Video: *The Rainforest* (National Geographic)

Test: Chapters 5 & 6

Chapter 7

Topic: Aquatic Ecology: Biodiversity in Aquatic Ecosystems

A. Saltwater life zones

B. Freshwater life zones

1. Eutrophication
2. Overturn
3. Characteristics of streams and rivers

Unit 4: Population

Chapter 8

Topic: Community Ecology, Structure, Species Interaction, Succession, and Sustainability

A. Nonnative or exotic species

B. Indicator species and keystone species

C. Interspecific and intraspecific competition

D. Competition and symbiosis

E. Succession

- Lab: Inter-and Intraspecific Competition: Students analyze the effects of population density on the growth of two plant species (radishes and collards) growing alone and in mixed species groups. Density and species composition are manipulated. The resulting biomasses of the two species are statistically analyzed.
- Video: *Cane Toads*

Test: Chapters 7 & 8

Chapter 9

Topic: Population Dynamics, Carrying Capacity, and Conservation Biology

A. Exponential versus logistic growth

B. Biotic potential and environmental resistance

C. Characteristics of r-strategists and K-strategists

D. Survivorship curves

- Lab: Duckweed Population Growth Lab: Students observe the growth of duckweed, an aquatic floating plant, and how its growth rate yields a logistic curve, illustrating concepts of population growth rates, carrying capacity, and limiting factors (such as light, pH, etc.).

Chapter 11

Topic: The Human Population: Growth, Demography, and Carrying Capacity

A. Zero population growth

B. Fertility and death rates

C. Age structure histograms

D. Factors affecting population size

E. The demographic transition

- Lab: Power of the Pyramids— Constructing Age-Sex Histograms: Students use census data to construct age-sex population pyramids. Such pyramids, representing several countries in various stages of development, are discussed and compared. Students then explore and discuss how the population would be affected by factors such as natural and human-made disasters as well as social, economic, and political changes.
- Video: *The People Bomb*
- Video: *World Population (Zero Population Growth)*

Test: Chapters 9 & 11

Unit 5: Land Use

Chapter 22

Topic: Sustaining Wild Species

A. Effect of humans on biodiversity

B. Estimation of extinction risks

C. Instrumental, ecological, economic, and intrinsic values of biodiversity

D. Causes of extinction

E. Laws and treaties to prevent extinction of species
(national and international)

F. Wildlife management

- Project: Endangered Species
- Video: *NOAH'S: Keepers of the Ark*

Chapter 23

Topic: Sustaining Terrestrial Biodiversity: The Ecosystem Approach

A. Land use in the United States and the world, including laws to manage public lands

B. Managing forests sustainably

1. Types of tree harvesting
2. Importance of fires

C. Managing tropical forests
D. Sustaining national parks
E. Gap analysis and ecological restoration

- Lab: Invertebrate Behavior

Test: Chapters 22 and 23

Chapter 12

Topic: Food Resources

A. Food production and nutrition
B. Increasing crop production

1. Genetic engineering
2. Irrigation

C. Meat production—Positive and negative effects
D. Harvesting fish and shellfish

Unit 6: Earth Systems

Chapter 10

Topic: Geology: Processes, Hazards, and Soils

A. Geologic processes and plate tectonics
B. Erosion and weathering
C. Rocks, minerals, and the rock cycle
D. Soil formation and soil profiles
E. Characteristics of soil and reading a soil triangle
F. Soil erosion, desertification, and salinization

- Lab: Soil Labs
- Lab: Rocks and the Rock Cycle
- Video: *Weathering and Soils: Earth Revealed*

Test: Chapters 10 and 12

Unit 7: Water Use

Chapter 13

Topic: Water Resources

A. Properties of water
B. Types of fresh water
C. Water shortages
D. Damming water and water transfer
E. Desalinization
F. Irrigation
G. Solutions to overuse of water
H. Flooding and floodplain management

- Video: *The Power of Water* (National Geographic)

Unit 8: Pollution

Chapter 17

Topic: Air and Air Pollution

A. Outdoor air pollution
  1. Photochemical and industrial smog
  2. Inversions
  3. Acid deposition

B. Indoor air pollution
  1. Types and sources
  2. Effects on human health
  - Video: Race to Save the Planet: Only One Atmosphere
  - Lab: Measuring Automobile Pollutants

C. Solutions to air pollution

Chapter 19

Topic: Water Pollution

A. Main types of water pollutants and how they are measured
B. Point and nonpoint sources of pollution
C. Stream pollution and oxygen-sag curves
D. Groundwater pollution
E. Ocean pollution
F. Wastewater treatment
  - Lab: Measuring Water Quality
  - Video: *Race to Save the Planet: Do We Really Want to Live This*
  - Video: *Land of the Alligator* (National Geographic)
  - Field trip: Wastewater treatment plant
  - Field Trip: Okefenokee Swamp
  - APES, AP Biology, Environmental Science

Chapter 21

Topic: Solid and Hazardous Waste

A. Municipal Solid Waste (MSW)
B. Hazardous waste
C. Reduce, reuse, recycle
D. Detoxifying, burning, burying, and exporting waste
E. Land disposal
F. Laws regarding hazardous waste in the United States
  - Video: *Endangered Planet*

Test: Chapters 16, 20, and 21

Chapter 24

Topic: Sustaining Aquatic Biodiversity

A. Importance and human impact on marine and aquatic biodiversity
B. Protecting and sustaining marine biodiversity
  - Lab: Macroinvertebrates as a Measurement of Water Quality: Students

assess the health of local surface water samples by conducting an analysis of macroinvertebrate diversity.

Test: Chapters 13, 19, and 24

Unit 9: Earth Resources, and Energy Resources and Consumption

Chapter 14

Topic: Geologic Resources: Nonrenewable Mineral & Energy Resources

A. Identifying, locating, and removing nonrenewable mineral resources
  1. Types of mining
  2. Environmental effects of mineral extraction

B. Oil extraction, refining, and use

C. Natural gas

D. Coal

E. Nuclear energy

Chapter 15

Topic: Energy Efficiency and Renewable Energy

A. Energy efficiency and how to improve it

B. Solar energy
  1. Passive solar energy
  2. Active solar energy

C. Hydroelectricity

D. Wind power

E. Biomass

F. Solar-hydrogen

G. Geothermal energy

H. Micropower

I. Sustainable energy use
  - Lab: Fossil Fuel lab—Personal Energy Audit
  - Project: Renewable and Nonrenewable Energy Sources—Pros and Cons

Test: Chapters 14 &15

Unit 10: Global Change

Chapter 18

Topic: Climate Change and Ozone Loss

A. Natural greenhouse effect

B. Global climate change

C. Possible solutions

D. Ozone depletion
  1. Causes and chemical reactions
  2. Effects on human health
  - Lab: Field Testing for Ozone: Schoenbein paper and relative humidity Schoenbein scale are used to measure the concentration of ozone in the air. This is then compared to concentrations in other time periods and in other parts of the world's atmosphere.

Test: Chapters 17 and 18

Unit 11: Ecological and Human Health

Chapter 16

Topic: Risk, Toxicology, and Human Health

A. Risks and hazards

B. Toxicology

1. Bioaccumulation and biomagnification
2. Poisons

C. Chemical hazards

D. Transmissible diseases

E. Risk analysis

- Lab: Toxicology—Testing LD-50: Four kinds of cleaning solutions (sodium hypochlorite, quaternary ammonium compounds, vinegar, and borates), are analyzed to determine the lethal dose 50 percent for yeast. Students write a report addressing dangers of current practices, effects on wildlife and people and make recommendations for more sustainable practices. A dose-response curve is required as part of analysis.

Chapter 20

Topic: Pesticides and Pest Control

A. Types of pesticides

B. Pros and cons of pesticide use

C. Pesticide treadmill and circle of poison

D. Pesticide regulations in the United States

E. Alternatives to the use of pesticides

F. Integrated pest management

- Lab: Herbicide Toxicity: Students determine the toxic dose for the plant Brassica rapa.

Chapter 21

Topic: Solid and Hazardous Waste

A. Municipal Solid
Waste (MSW)

B. Hazardous waste

C. Reduce, reuse, recycle

D. Detoxifying, burning, burying, and exporting waste

E. Land disposal

F. Laws regarding hazardous waste in the United States

- Video: *Endangered Planet*

Test: Chapters 16, 20, and 21

Unit 12: Other Topics

Chapters 26, 27 and 28

Topic: Environment and Society

- Worked throughout the year as other topics are covered

AP Environmental Science Exam

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Course Syllabus

Course Title: *AP Physics C – Mechanics*

Texts
While I currently use Raymond A. Serway and Robert J. Beichner's *Physics for Scientists and Engineers,* 6th ed., *Fundamentals of Physics* by David Halliday, Robert Resnick, and Jearl Walker.

Schedule
All classes meet five days a week in 45-minute periods. The semester is 90 days. With this calendar, it is necessary to organize the course within a tight schedule that includes assignments during some holiday breaks. I find it useful to lay out a calendar by which to measure progress through the material, in order to insure completion with time for sufficient review before the AP Physics Exam. The calendar reflects the day-by-day unit assignment schedule outlined below.

Mechanics Outline
Mechanics is covered during the fall semester, with each subject covered in the same order as in Serway and other standard texts. Concepts and problem-solving techniques are introduced through a combination of lectures, demonstrations, question–answer sessions, and teacher-generated worksheets, with the text acting as a back-up resource. Calculus is used throughout and where appropriate.

Unit	Topics	Chapters in Serway	Number of Days
Unit 1	**SI Units, Dimensional Analysis, & Vectors**	1, 2	5
	Introduction to Lab		
Unit 2	**Rectilinear Motion**	3	5
	Kinematics w/time-varying acceleration		
	Kinematics w/constant acceleration		
Unit 3	**Planar Motion**		7
	General motion where x and y vary w/time		
	Kinematics of projectiles		
	Kinematics of circular motion		
Unit 4	**Introduction to Newton's Laws**	5	5
	Newton's three Laws		
	Free-body diagrams		
	Introduction to weight, normal, and friction forces		
Unit 5	**Applications of Newton's Laws**	5, 6	8
	Pulley system		
	Uniform circular motion		
	Nonuniform circular motion		
	Nonconstant friction force		

Unit 6	**Vector Multiplication**	7, 11	3
Unit 7	**Work, Energy, and Power**	7	4
	Work by constant force		
	Work by position-varying force		
	Work-energy theorem		
	Power		
Unit 8	**Conservation of Energy**	8	8
	Energy conservation		
	Work by nonconservative forces		
	Potential energy functions		
	Potential energy vs. Position graphs		
Unit 9	**Impulse, Momentum, and Collisions**	10, 11	7
	Impulse-momentum relationship		
	Conservation of linear momentum		
	Elastic and inelastic collisions		
	Position and velocity of center of mass		
Unit 10	**Rotational Kinematics**	10, 11	4
	Kinematics w/time-varying angular acceleration		
	Kinematics w/constant angular momentum		
	Introduction to torque and angular momentum		
Unit 11	**Rotational Dynamics**	10, 11	7
	Moment of inertia		
	Newton's laws for rotation		
	Conservation of energy with rotation		
	Conservation of angular momentum		
Unit 12	**Translational and Rotational Equilibrium**	12	4
Unit 13	**Gravitation**	14	6
	Kepler's Law		
	Newton's law of gravitation		
	Energy and angular momentum		
Unit 14	**Simple Harmonic Motion (SHM)**	13	6
	Kinetics of SHM		
	Dynamics of SHM		

Teaching Strategies

Lecture and Question–Answer Sessions

Other than lab experiments, class time is taken up with lecture and question–answer sessions. A "lecture" consumes 20 to 30 minutes during which a concept presented in the reading is reviewed, stressing important definitions and limitations. The remainder of the period usually involves showing relevant demonstrations (toys are frequently used), and then introducing an assigned problem or set of problems related to the demonstration. The students are then guided in a discussion (whole class or small group) to develop solutions to the problem(s). During all of these activities, I encourage discussion, questions, hypotheses, and proposals to flow among the students themselves and between the students and me. Demonstrations are chosen to give the students as many different "looks" at the application of a concept as possible, so an appreciation of the universality of physical concepts is developed. Live demonstrations with simple equipment, often done by the students themselves for the rest of the class, are preferred. Computer simulations and video demonstrations have their place when real equipment is not available. Whenever possible, I use the analogies, conceptual discoveries, and problem-solving techniques that helped my understanding when I was a student.

Problem Assignments

At the beginning of each unit, I give students a list of "what you should know and be able to do" by the end of the unit, a day-to-day schedule with assignments, the experiments scheduled, and when a quiz on the material can be expected. Providing this informs the students about the work required to master the objectives of the unit.

The assigned problems are either from the textbook or from a supplementary problem handout. Problems are chosen to give students experience with a wide range of applications of the subject covered in the unit. When the textbook does not have a problem covering a particular application, I use one from another text or write one. These make up the supplementary problem list. I also make extensive use of worksheets that are designed to help students develop coherent problem-solving techniques. When working problems or in question–answer sessions, I always stress starting from a general principle and moving toward a specific application. Instead of spending class time on working a problem all the way through to the answer, we work on building a general-to-specific routine in solving problems. This is an important skill to develop for success in future course work in the long term and for success on the AP Exam in the short term, since most problems students encounter will not be of the specific type they have worked before.

Lab Experiments

Approximately 20 percent of class time is taken up by lab work. The experience gained by manipulating equipment, recording and organizing data, and drawing conclusions through data and error analysis should be a vital part of any physics course; most labs extend beyond one class period. Much of the newer technology based lab equipment does not fit my style because once it is set up, the data is taken, necessary calculations are performed, and graphs are produced at the push of a button without much thought by the students. To me, a valuable learning opportunity is lost when students are not required to work with the data and organize it into a form in which a conclusion can be drawn. In my labs, students use simple equipment with a minimum of "black boxes." Lab experiments are, for the most part, written by me and chosen to provide students with experiences that reinforce concepts being covered in class. Lab reports are required and are kept in a lab notebook.

Mechanics Labs

1. **Analysis of an Experiment.** Introduction to graphing techniques to derive an equation relating to experimental quantities (adapted from *PSSC Physics Laboratory Guide*).

2. **Motion with Uniform Acceleration.** Air track and interval timers (photogates or CBL™) used to gather data to produce a *v* versus *t* graph. Covers slopedifferential and area-integral concepts. Acceleration of gravity (*g*) is found experimentally. Introduction to least squares fit.

3. **Measuring the Acceleration of Gravity, *g*.** Choice of three experimental methods for measuring *g*.

4. **Newton's Second Law.** This demonstration experiment uses an air track, pulley,

and decade timer combination to derive the second law.

5. **Atwood's Machine.** A simple mass/pulley Atwood's Machine is used to measure the acceleration of the system and compare it with the theoretical acceleration found using Newton's laws. The apparatus is then used to measure the mass of a penny.

6. **The Coefficient of Kinetic Friction, uk.** This demonstration experiment is used to determine the coefficient of friction between an air track cart and masking tape.

7. **The Conical Pendulum.** Measurements are made with a toy airplane moving as a conical pendulum; centripetal force is related to the period of rotation of the plane, the radius of its circular path, and the tension in its support string.

8. **Changes in Potential Energy.** Energy exchanges in a spring-mass system. A relationship is determined between the area of F versus x graph and potential energy integral. (Adapted from *PSSC Physics Laboratory Guide.*)

9. **Explosions and Collisions.** Photo slides of an "explosion" and collisions of discs on a low-friction surface are used to investigate conservation of momentum, position, and velocity of the center of mass, and energy exchanges.

10. **Energy, Momentum, and a Crossbow.** Using a ballistic pendulum and toy crossbow, momentum and energy conversions are investigated.

11. **Jupiter Satellite Orbit.** The mass of Jupiter is determined using the period and radius of the orbit of its moon Io. (Project Physics film loop #12, currently available as part of *Physics: Cinema Classics* video-disc from AAPT.)

12. **The Physical Pendulum.** Compares the experimental and calculated period of a physical pendulum.

Evaluation

Quizzes are given approximately every two units. The quizzes are purposely similar in construction to the AP Exam. Each consists of 8 to 12 multiple-choice questions and a multipart free-response question. A teacher-constructed "anti-memorization" sheet is permitted on all quizzes. While going through the course material, the stress is on developing concepts and problem-solving strategies, not on memorization.

The multiple-choice questions come from many sources, such as AP Released Exams, New York Regents Exam review books, and questions I have written. The free-response questions have the same format as those on the AP Exam, and most are modified AP Exam questions. All are constructed to test current material and material previously covered. For example, an energy free-response question might require a free-body diagram and have a part involving a trajectory.

The day after the quizzes are given, students score each other's papers using a rubric similar to those used to score the free-response questions on the AP Exam. The solution is projected on a screen, showing where points are to be given. Before students begin scoring papers, each section of the solution is carefully explained. This requires them to go through the solution carefully, perhaps recognizing their own mistakes and perhaps learning a little from the mistakes of others.

The only cumulative examination given before AP Exam review time is the first semester final. It consists of the 35-question multiple-choice section from an AP Physics C: Mechanics Released Exam. This exam is taken, scored, and reviewed during a two-hour final exam period.

Homework

Homework is assigned through a day-by-day assignment sheet, which students are given at the beginning of each unit. After they have had the chance to ask about a group of assigned problems or a worksheet, two to five problems and/or a worksheet are handed in at random intervals during the unit. Homework is accepted only when asked for. This encourages students to stay current in their assignments. Since they have had the chance to ask questions, the homework they hand in is expected to be correct.

Grading

Lab reports are worth 20 points. Quizzes are worth 25 to 30 points, with the multiple-choice questions worth one point apiece and the free-response questions worth the remainder of the points. The homework collected in each unit is worth roughly half a quiz grade. The semester final and review exams are worth 35 points each. Extra credit—which can range from helping set up labs, building a car within stated design parameters, and working out amusement park problems—is liberally sprinkled throughout the course. All points are added and the percentage of points possible is determined.
Grades are assigned according to the following schedule:

A = 85–100%; B = 70–84%; C = 55–69%; D = 45–54%; E = below 45%

Having taught the course for more than 20 years, I calibrate the points available to result in half to two-thirds of the students earning grades of A or B.

AP Exam Review

Formal review begins two weeks before the beginning of the AP Exam administration. Each student is given an exam review booklet consisting of the multiple-choice sections from two AP Physics C Released Exams and the free-response questions from the last five exams. In the booklet is a listing of the multiple-choice questions sorted by subject (i.e., kinematics, Newton's laws, etc.). During the early part of the review, several of these subject areas are assigned as homework. The first part of each class period is used to answer questions on the previous day's assignment. The rest of the period is divided up into 15-minute intervals, and one free-response question is assigned during each interval. Students may work alone or in groups of no more than three. Solution notebooks are available in the classroom for students to check their work. At the end of the first week of review, the mechanics multiple-choice questions from an AP Released Physics C Exam are given for credit. After the end of the second week, the multiple-choice questions from the E&M exam are given.

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eoc tech

Course Syllabus

Course Title: *AP Physics C – Electricity & Magnetism*

School Calendar and Schedule

The academic year runs from mid-August until late May. The class meets for 45 minutes each day

Student Prerequisites

All students must have had a prior physics course such as Physics B or general physics and must be co-enrolled in integral calculus, as calculus is used extensively throughout the course.

Textbooks

The textbook distributed to the students is *Physics for Scientists and Engineers* by Serway and Beichner, 5th edition, 2000. A classroom set of Halliday and Resnick, 4th edition, is available for additional problems. Teacher-generated notes are also available.

Technology

An electronic student response system is used for daily review. Laptop computers equipped with data acquisition hardware and software is available for laboratory use. Wireless access to the Internet is provided in the laboratory. The instructor maintains a website for student use from home.

Assessments

In addition to the assessments detailed in each unit, a summative exam consisting of multiple-choice and free-response components is given at the end of the unit.
Frequent quizzes for formative assessment are given.

Homework is graded for completion and spot-checked for correctness.

There is a major emphasis on lab work. Labs are usually designed for the students to discover concepts with a minimum of teacher input. Students are encouraged and guided to develop their own hypotheses, experiments, and conclusions. Results are often shared between students in order to discuss their conclusions and error analysis. Hands-on laboratory experiments comprise 20 percent of class time. Additional time is spent on computer simulation–based laboratories. Lab reports are required for all labs and must be collected by the student in a lab notebook.

Inquiry-based formative assessment exercises are carried out by small groups of students each week.

In April, students take a full-length practice AP Exam.

Unit 1: The Electric Field (1 week)

Objectives

Charge and Coulomb's Law, the electric field, point charge distributions, continuous charge distributions, motion of charged particles in an electric field

Student Activities

- Electroscope lab: Construction and discovery, among other things, of how to charge the electroscope (+ and -). Simulation lab: Using the E-field plotter program, students construct point charge distributions and examine the resulting computer-generated electric field.

Assessments

- Written procedure and informal assessment of results

Unit 2: Gauss's Law (1 1/2 weeks)

Objectives

Electric flux, Gauss's Law (general), Gauss's Law and various continuous charge distributions

Student Activities

- Students derive electric fields associated with charged conductors and non-conductors and produce appropriate graphs.

Assessments

- Worksheet graded

Unit 3: Electric Potential (1 1/2 weeks)

Objectives

Electric potential and potential difference, potential differences in uniform electric fields, potential and point charges, potential and continuous charge distributions

Student Activities

- Simulation lab: Using the E-field plotter or another computer program, students construct charge distributions consisting of point charges, and examine the resulting computer-generated potential surfaces.
- *AP Physics Lab Guide Experiment: Electric Power and Batteries (1 and 2)*
- Students derive electric potentials for continuous charge distributions and produce appropriate graphs.

Assessments

- Informal assessment and worksheet graded

Unit 4: Capacitance (1 week)

Objectives

Capacitance, Gauss's Law and capacitance, combination of capacitors, energy stored in capacitors, Dielectrics

Student Activities

- The procedure for using Gauss's Law to analyze parallel plate, and cylindrical and spherical capacitors is developed and practiced.
- Capacitor lab: Using two identical commercial capacitors and one D-cell, create series and parallel

circuits to charge the capacitors. Measure the voltage across the plates of each capacitor when connected to the cell and when disconnected.
- Discharge the capacitors through light bulbs for a qualitative assessment of energy stored.

Assessments
- Worksheet completion
- Lab report showing circuits and describing results

Unit 5: DC Circuits (2 weeks)

Objectives

Ohm's Law, resistivity, electrical power, electromotive force and internal resistance, equivalent resistance, Kirchhoff's rules, RC circuits

Student Activities
- AP Physics Lab Guide Experiment: Ohm's Law (1 and 2)
- Resistivity lab: In this inquiry-based lab, students construct resistors from carbonized paper. They measure resistance and calculate resistivity given the resistor dimensions.
- Multiloop circuit lab: Students construct multiloop circuits or are provided with simulations of such circuits. Programmable calculators are used to solve equations simultaneously to analyze the current in each loop.
- AP Physics Lab Guide Experiment:
- RC Time Constant: Students construct RC circuits with known resistors and capacitors. Computers with data acquisition hardware and software are used to analyze the circuit. Time constant and amount of charge stored on the capacitor must be obtainable from graphs generated.

Assessments
- Lab reports with circuit diagrams and calculations

Unit 6: Magnetostatics (2 weeks)

Objectives

Magnetic force on moving charges and currents, path of moving charge in a magnetic field, Hall effect, Biot–Savart law, parallel conductors, Ampere's law, solenoids and toroids

Student Activities
- Magnetic force lab: Students construct a device that shows the existence of a magnetic force on a current-carrying wire using common lab equipment.
- Hall effect lab: Students show the Hall effect using computers and data acquisition technology.
- Solenoid lab: The measurement of magnetic field inside a solenoid and its variation with current. Students calculate how many layers of wire are wrapped around the solenoid core.

Assessments
- Assessment of student demo and explanation during activity
- Lab reports containing data table and calculations

Unit 7: Magnetic Induction (2 weeks)

Objectives

Magnetic flux, Gauss's law of magnetism, Faraday's law of induction, Lenz's law, induced *emf* and electric fields, generators and motors, Maxwell's equations

Student Activities

- Faraday's Law of Induction lab: Students are provided with two solenoids (one of which fits inside the other), an iron bar, computers, and voltage sensors to illustrate Faraday's Law.
- Motor/generator presentation lab: Students dissect a small electric motor or generator and, using digital photographs or other diagrams, produce a PowerPoint presentation describing how it works.

Assessments

- Lab report of data and explanation of results
- Assessment of PowerPoint presentation

Unit: Inductance (1.5 weeks)

Objectives

Self-inductance, RL circuits, energy in magnetic fields, mutual inductance, electronic oscillations in LC circuits, the RLC circuit

Student Activities

- Differential equation worksheet: Differential equations for electronic oscillator; similarities with mechanical oscillators
- Synthesized music presentation lab: Students do an Internet investigation and create a PowerPoint lesson describing how electronic music is produced. Alternatively, they may dissect a cheap piece of electronic equipment and describe how it works.

Assessments

- Worksheet completion
- Assessment of presentation

eoc tech

Introduction to Engineering Design (IED)
Course Description

Introduction to Engineering Design™ (IED) is a high school level course that is appropriate for 9th or 10th grade students who are interested in design and engineering. The major focus of the IED course is to expose students to design process, research and analysis, teamwork, communication methods, global and human impacts, engineering standards, and technical documentation. IED gives students the opportunity to develop skills and understanding of course concepts through activity-, project-, and problem-based (APPB) learning. Used in combination with a teaming approach, APPB-learning challenges students to continually hone their interpersonal skills, creative abilities and understanding of the design process. It also allows students to develop strategies to enable and direct their own learning, which is the ultimate goal of education.

The course assumes no previous knowledge, but students should be concurrently enrolled in college preparatory mathematics and science. Students will employ engineering and scientific concepts in the solution of engineering design problems. In addition, students use a state of the art 3D sold modeling design software package to help them design solutions to solve proposed problems. Students will develop problem-solving skills and apply their knowledge of research and design to create solutions to various challenges that increase in difficulty throughout the course. Students will also learn how to document their work, and communicate their solutions to their peers and members of the professional community.

Introduction to Engineering Design™ is one of the three foundation courses in the Project Lead The Way® high school pre-engineering program. The course applies and concurrently develops secondary level knowledge and skills in mathematics, science, and technology.

The course of study includes:

- Design process
- Modeling
- Sketching
- Measurement, Statistics, and Applied Geometry
- Presentation Design and Delivery
- Engineering Drawing Standards
- CAD Solid Modeling
- Reverse Engineering
- Consumer Product Design Innovation
- Marketing
- Graphic Design
- Engineering Ethics
- Virtual Design Teams

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Course Title: *Introduction to Engineering Design*

Description

In this course, students use 3D solid modeling design software to help them design solutions to solve proposed problems. Students will learn how to document their work and communicate solutions to peers and members of the professional community. This course is designed for 9th or 10th grade students. The major focus of the IED course is to expose students to the design process, research and analysis, teamwork, communication methods, global and human impacts, engineering standards and technical documentation.

Instructor
Edward Lord
405-390-5359
elord@eoctech.org

Course Number OCAS Number	OHLAP Credit	Length	Prerequisites
ST00023 8709	Yes	120 Clock Hours	Algebra I, Geometry

Objectives/Knowledge and Skills:

Design Process

Introduction to a Design Process
Concepts Addressed in Lesson:

- There are many design processes that guide professionals in developing solutions to problems.
- A design process most used by engineers includes defining a problem, brainstorming, researching, identifying requirements, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype, testing, refining, making, and communicating results.
- Design teams use brainstorming techniques to generate large numbers of ideas in short time periods.
- Engineers conduct research to develop their knowledge base, stimulate creative ideas, and make informed decisions.
- A designer uses an engineer's notebook to chronologically document all aspects of a design project.

Introduction to Technical Sketching and Drawing
Concepts Addressed in Lesson:

- Engineers create sketches to quickly record, communicate, and investigate ideas.
- Pictorials and tonal shading techniques are used in combination to give sketched objects a realistic look.
- Designers use isometric, oblique, perspective, and multiview sketching to maintain an object's visual proportions.
- A multiview projection is the most common method of communicating the shape and size of an object that is intended for manufacture.

Measurement and Statistics
Concepts Addressed in Lesson:

- Measurement systems were developed out of the need for standardization.
- Engineers apply dimensions to drawings to communicate size information.
- Manufactured parts are often created in different countries, where dimensional values are often converted from one standard unit to another.
- The amount of variation that can be measured depends on the precision of the measuring tool.
- Statistical analysis of measurements can help to verify the quality of a design or process.
- Engineers use graphics to communicate patterns in recorded data.

Puzzle Cube
Concepts Addressed in Lesson:

- Three-dimensional forms are derived from two-dimensional shapes.
- The results of the design process are commonly displayed as a physical model.
- Engineers develop models to communicate and evaluate possible solutions.
- Geometric and numeric constraints are used to define the shape and size of objects in Computer Aided Design (CAD) modeling systems.
- Engineers use CAD modeling systems to quickly generate and annotate working drawings.
- Packaging not only protects a product, but contributes to that product's commercial success.

Design Exercises

Geometric Shapes and Solids
Concepts Addressed in Lesson:

- Geometric shapes describe the two or three dimensional contours that characterize an object.
- The properties of volume and surface area are common to all designed objects and provide useful information to the engineer.
- CAD systems are used to increase productivity and reduce design costs.
- Solid CAD models are the result of both additive and subtractive processes.

Dimensions and Tolerances
Concepts Addressed in Lesson:

- Working drawings should contain only the dimensions that are necessary to build and inspect an object.
- Object features require specialized dimensions and symbols to communicate technical information, such as size.
- There is always a degree of variation between the actual manufactured object and its dimensioned drawing.
- Engineers specify tolerances to indicate the amount of dimensional variation that may occur without adversely affecting an object's function.
- Tolerances for mating part features are determined by the type of fit.

Advanced Modeling Skills
Concepts Addressed in Lesson:

- Solid modeling programs allow the designer to create quality designs for production in far less time than traditional design methods.
- Engineers use CAD models, assemblies, and animations to check for design problems, verify the functional qualities of a design, and communicate information to other professionals and clients.
- Auxiliary views allow the engineer to communicate information about an object's inclined surfaces that appear foreshortened in basic multiview drawings.
- Designers use sectional views to communicate an object's interior features that may be difficult to visualize from the outside.

- As individual objects are assembled together, their degrees of freedom are systematically removed.
- Engineers create mathematical formulas to establish geometric and functional relationships within their designs.
- A title block provides the engineer and manufacturer with important information about an object and its creator.
- A parts list and balloons are used to identify individual components in an assembly drawing.

Advanced Designs
Concepts Addressed in Lesson:

- Design solutions can be created as an individual or in teams.
- Engineers use design briefs to explain the problem, identify solution expectations, and establish project constraints.
- Teamwork requires constant communication to achieve the goal at hand.
- Engineers conduct research to develop their knowledge base, stimulate creative ideas, and make informed decisions.
- Engineers use a design process to create solutions to existing problems.
- Engineers use CAD modeling systems to quickly generate and annotate working drawings.
- Fluid Power Concepts could be used to enhance design solutions.

Reverse Engineering

Visual Analysis
Concepts Addressed in Lesson:

- Visual design principles and elements constitute an aesthetic vocabulary that is used to describe any object independent of its formal title, structural, and functional qualities.
- Tangible design elements are manipulated according to conceptual design principles.
- Aesthetic appeal results from the interplay between design principles and elements.
- Though distinctly different, a design's visual characteristics are influenced by its structural and functional requirements.
- Visual appeal influences a design's commercial success.
- Graphic designers are concerned with developing visual messages that make people in a target audience respond in a predictable and favorable manner.

Functional Analysis
Concepts Addressed in Lesson:

- Mechanisms use simple machines to move loads through the input of applied effort forces.
- Engineers perform reverse engineering on products to study their visual, functional, and structural qualities.
- Through observation and analysis, a product's function can be divided into a sequence of operations.
- Products operate as systems, with identifiable inputs and outputs.

Structural Analysis
Concepts Addressed in Lesson:

- Objects are held together by means of joinery, fasteners, or adhesives.
- Precision measurement tools and techniques are used to accurately record an object's geometry.
- Operational conditions, material properties, and manufacturing methods help engineers determine the material makeup of a design.
- Engineers use reference sources and computer-aided design (CAD) systems to calculate the mass properties of designed objects.

Product Improvement By Design
Concepts Addressed in Lesson:

- Engineers analyze designs to identify shortcomings and opportunities for innovation.
- Design teams use brainstorming techniques to generate large numbers of ideas in short time periods.
- Engineers use decision matrices to help make design decisions that are based on analysis and logic.
- Engineers spend a great deal of time writing technical reports to explain project information to various audiences.

Open-Ended Design Problems

Engineering Design Ethics
Concepts Addressed in Lesson:

- The material of a product, how the material is prepared for use, its durability, and ease of recycling all impact a product's design, marketability, and life expectancy.
- All products made, regardless of material type, may have both positive and negative impacts.
- In addition to economics and resources, manufacturers must consider human and global impacts of various manufacturing process options.
- Laws and guidelines have been established to protect humans and the global environment.
- A conscious effort by product designers and engineers to investigate the recyclable uses of materials will play a vital role in the future of landfills and the environment.

Design Teams
Concepts Addressed in Lesson:

- Teams of people can accomplish more than one individual working alone.
- Design teams establish group norms through brainstorming and consensus to regulate proper and acceptable behavior by and between team members.
- Engineers develop Gantt charts to plan, manage, and control a design team's actions on projects that have definite beginning and end dates.
- Virtual teams rely on communications other than face-to-face contact to work effectively to solve problems.
- Each team member's strengths are a support mechanism for the other team members' weaknesses.
- Conflict between team members is a normal occurrence, and can be addressed using formal conflict resolution strategies.

Evaluation

End of course assessment administered through PLTW, college credit available. The following grade scale will be used:

A = 100-90
B = 89-80
C = 79-70
D = 69-60
F = 59-below

The student will have one semester to complete this course. Students will participate in class discussion, make presentations, effectively demonstrate physical skills, and pass written tests.

Makeup work policies: *All* work missed due to an ***excused*** absence, including school activity, must be turned in within three (3) school days of the date of absence in order to receive full credit. The student must make arrangements with the instructor, in advance if possible, to schedule make-up work due to an extended absence situation.

Curriculum Resources

Project Lead The Way, www.pltw.org

Principles of Engineering (POE)
Course Description

Principles of Engineering (POE) is a high school-level survey course of engineering. The course exposes students to some of the major concepts that they will encounter in a postsecondary engineering course of study. Students have an opportunity to investigate engineering and high tech careers. POE gives students the opportunity to develop skills and understanding of course concepts through activity-, project-, and problem-based (APPB) learning. Used in combination with a teaming approach, APPB learning challenges students to continually hone their interpersonal skills, creative abilities, and problem solving skills based upon engineering concepts. It also allows students to develop strategies to enable and direct their own learning, which is the ultimate goal of education.

To be successful in POE, students should be concurrently enrolled in college preparatory mathematics and science. Students will employ engineering and scientific concepts in the solution of engineering design problems. Students will develop problem-solving skills and apply their knowledge of research and design to create solutions to various challenges. Students will also learn how to document their work and communicate their solutions to their peers and members of the professional community.

Principles of Engineering is one of three foundation courses in the Project Lead The Way® high school engineering program. The course applies and concurrently develops secondary level knowledge and skills in mathematics, science, and technology.

The course of study includes:

- Mechanisms
- Energy Sources
- Energy Applications
- Machine Control
- Fluid Power
- Statics
- Material Properties
- Material Testing
- Statistics
- Kinematics

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Course Title: *Principles of Engineering*

Description
This survey course of engineering exposes students to some of the major concepts they'll encounter in a postsecondary engineering course of study. Students have an opportunity to investigate engineering and high-tech careers and to develop skills and understanding of course concepts. Students employ engineering and scientific concepts in the solution of engineering design problems. They develop problem-solving skills and apply their knowledge of research and design to create solutions to various challenges. Students also learn how to document their work and communicate their solutions to peers and members of the professional community. This course is designed for 10th or 11th grade students.

Instructor
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CTE Number OCAS Number	OHLAP Credit	Length	Prerequisites
ST00024 8710	Yes	120 Clock Hours	Algebra I Geometry

Objectives/Knowledge and Skills:
Energy and Power

Mechanisms
Concepts Addressed:

- Engineers and engineering technologists apply math, science, and discipline-specific skills to solve problems.
- Engineering and engineering technology careers offer creative job opportunities for individuals with a wide variety of backgrounds and goals.
- Technical communication can be accomplished in oral, written, and visual forms and must be organized in a clear and concise manner.
- Most mechanisms are composed of gears, sprockets, pulley systems, and simple machines.
- Mechanisms are used to redirect energy within a system by manipulating force, speed, and distance.
- Mechanical advantage ratios mathematically evaluate input work versus output work of mechanisms.

Performance Objectives Addressed in Lesson:

It is expected that students will:

- Differentiate between engineering and engineering technology.
- Conduct a professional interview and reflect on it in writing.
- Identify and differentiate among different engineering disciplines.
- Measure forces and distances related to mechanisms.
- Distinguish between the six simple machines, their attributes, and components.
- Calculate mechanical advantage and drive ratios of mechanisms.
- Design, create, and test gear, pulley, and sprocket systems.
- Calculate work and power in mechanical systems.

- Determine efficiency in a mechanical system.
- Design, create, test, and evaluate a compound machine design.

Energy Sources
Concepts Addressed in Lesson:

- Energy source classifications include nonrenewable, renewable, and inexhaustible.
- Energy source processes include harnessing, storing, transporting, and converting.
- Energy often needs to be converted from one form to another to meet the needs of a given system.
- An understanding of work, energy, and power is required to determine system efficiency.
- An understanding of the basics of electricity requires the understanding of three fundamental concepts of voltage, current, and resistance.
- The atomic structure of a material determines whether it is a conductor, an insulator, or a semiconductor.

Performance Objectives Addressed in Lesson:

It is expected that students will:

- Identify and categorize energy sources as nonrenewable, renewable, or inexhaustible.
- Create and deliver a presentation to explain a specific energy source.
- Summarize and reflect upon information collected during a visit to a local utility company.
- Define the possible types of power conversion.
- Calculate work and power.
- Demonstrate the correct use of a digital multimeter.
- Calculate power in a system that converts energy from electrical to mechanical.
- Determine efficiency of a system that converts an electrical input to a mechanical output.
- Calculate circuit resistance, current, and voltage using Ohm's law.
- Understand the advantages and disadvantages of parallel and series circuit design in an application.

Energy Applications
Concepts Addressed in Lesson:

- Energy management is focused on efficient and accessible energy use.
- System energy requirements must be understood in order to select the proper energy source.
- Energy systems can include multiple energy sources that can be combined to convert energy into useful forms.
- Hydrogen fuel cells create electricity and heat through an electrochemical process that converts hydrogen and oxygen into water.
- Solar cells convert light energy into electricity by using photons to create electron flow.
- Thermodynamics is the study of the effects of work, thermo energy, and energy on a system.
- Thermo energy can transfer via convection, conduction, or radiation.
- Material conductivity, resistance, and energy transfer can be calculated.

Performance Objectives Addressed in Lesson:

It is expected that students will:

- Test and apply the relationship between voltage, current, and resistance relating to a photovoltaic cell and a hydrogen fuel cell.
- Experiment with a solar hydrogen system to produce mechanical power.
- Design, construct, and test recyclable insulation materials.

- Test and apply the relationship between R-values and recyclable insulation.
- Complete calculations for conduction, R-values, and radiation.

Design Problem – Energy and Power
Concepts Addressed in Lesson:

- Design problems can be solved by individuals or in teams.
- Engineers use a design process to create solutions to existing problems.
- Design briefs are used to identify the problem specifications and to establish project constraints.
- Teamwork requires constant communication to achieve the desired goal.
- Design teams conduct research to develop their knowledge base, stimulate creative ideas, and make informed decisions.

Performance Objectives Addressed in Lesson:

It is expected that students will:

- Brainstorm and sketch possible solutions to an existing design problem.
- Create a decision-making matrix for a design problem.
- Select an approach that meets or satisfies the constraints provided in a design brief.
- Create a detailed pictorial sketch or use 3D modeling software to document the best choice, based upon the design team's decision matrix.
- Present a workable solution to the design problem.

Materials and Structures

Statics
Concepts Addressed in Lesson:

- Laws of motion describe the interaction of forces acting on a body.
- Structural member properties including centroid location, moment of inertia, and modulus of elasticity are important considerations for structure design.
- Static equilibrium occurs when the sum of all forces acting on a body are equal to zero.
- Applied forces are vector quantities with a defined magnitude, direction, and sense, and can be broken into vector components.
- Forces acting at a distance from an axis or point attempt or cause an object to rotate.
- In a statically determinate truss, translational and rotational equilibrium equations can be used to calculate external and internal forces.
- Free body diagrams are used to illustrate and calculate forces acting upon a given body.

Performance Objectives Addressed in Lesson:

It is expected that students will:

- Create free body diagrams of objects, identifying all forces acting on the object.
- Mathematically locate the centroid of structural members.
- Calculate moment of inertia of structural members.
- Differentiate between scalar and vector quantities.
- Identify magnitude, direction, and sense of a vector.
- Calculate the X and Y components given a vector.
- Calculate moment forces given a specified axis.
- Use equations of equilibrium to calculate unknown forces.
- Use the method of joints strategy to determine forces in the members of a statically determinate truss.

Material Properties
Concepts Addressed in Lesson:

- Materials are the substances with which all objects are made.
- Materials are composed of elements and area categorized by physical and chemical properties.
- Materials consist of pure elements. Compounds and mixtures and are typically classified as metallic, ceramic, organic, polymeric, and composite.
- Material properties including recyclability and cost are important considerations for engineers when choosing appropriate materials for a design.
- Material selection is based upon mechanical, thermal, electromagnetic, and chemical properties.
- Raw materials undergo various manufacturing processes in the production of consumer goods.

Performance Objectives Addressed in Lesson:

It is expected that students will:

- Investigate specific material properties related to a common household product.
- Conduct investigative non-destructive material property tests on selected common household products. Property testing conducted to identify continuity, ferrous metal, hardness, and flexure.
- Calculate weight, volume, mass, density, and surface area of selected common household product
- Identify the manufacturing processes used to create the selected common household product.
- Identify the recycling codes.
- Promote recycling using current media trends.

Material Testing
Concepts Addressed in Lesson:

- Engineers utilize a design process and mathematical formulas to solve and document design problems.
- Material testing aids in determining a product's reliability, safety, and predictability in function.
- Engineers perform destructive and non-destructive tests on material specimens for the purpose of identifying and verifying the properties of various materials.
- Material testing provides a reproducible evaluation of material properties.
- Tensile testing data is used to create a test sample stress strain curve.
- Stress strain data points are used to identify and calculate sample material properties including elastic range, proportional limit, modulus of elasticity, elastic limit, resilience, yield point, plastic deformation, ultimate strength, failure, and ductility.

Performance Objectives Addressed in Lesson:

It is expected that students will:

- Utilize a five-step technique to solve word problems.
- Obtain measurements of material samples.
- Tensile test a material test sample.
- Identify and calculate test sample material properties using a stress strain curve.

Design Problem – Materials and Structures
Concepts Addressed in Lesson:

- Design problems can be solved by individuals or in teams.
- Engineers use a design process to create solutions to existing problems.
- Design briefs are used to identify the problem specifications and establish project constraints.
- Teamwork requires constant communication to achieve the desired goal.
- Design teams conduct research to develop their knowledge base, stimulate creative ideas, and make informed decisions.

Performance Objectives Addressed in Lesson:

It is expected that students will:

- Brainstorm and sketch possible solutions to an existing design problem.
- Create a decision making matrix for the design problem.
- Select an approach that meets or satisfies the constraints given in a design brief.
- Create a detailed pictorial sketch or use 3D modeling software to document the best choice, based upon your team's decision matrix.
- Present a workable design solution.

Control Systems

Machine Control
Concepts Addressed in Lesson:

- Flowcharts provide a step by step schematic representation of an algorithm or process.
- Control systems are designed to provide consentient process control and reliability.
- Control system protocols are an established set of commands or functions typically created in a computer programming language.
- Closed loop systems use digital and analog sensor feedback to make operational and process decisions.
- Open loop systems use programming constants such as time to make operational and process decisions.

Performance Objectives Addressed in Lesson:

It is expected that students will:

- Create detailed flow charts utilizing a computer software application.
- Create control system operating programs utilizing computer software.
- Create system control programs that utilize flowchart logic.
- Choose appropriate inputs and output devices based on the need of a technological system.
- Differentiate between the characteristics of digital and analog devices.
- Judge between open and closed loop systems in order to choose the most appropriate system for a given technological problem.
- Design and create a control system based on given needs and constraints.

Fluid Power
Concepts Addressed in Lesson:

- Fluid power systems are categorized as either pneumatic, which utilizes gas, or hydraulic, which utilizes liquid.
- Fluid power is possible because in a system of confined fluid, pressure acts equally in all directions.
- The most basic components of all fluid power systems include a reservoir or receiver, a pump or compressor, a valve, and a cylinder.
- Fluid power systems are designed to transmit force over great distances, multiply an input force, and increase the distance that an output will move.
- Laws about the behavior of fluid systems and standard conventions for calculating values within fluid systems aid in the design and understanding of such systems.
- Standard schematic symbols and conventions are used to communicate fluid power designs.

Performance Objectives Addressed in Lesson:

It is expected that students will:

- Identify devices that utilize fluid power.
- Identify and explain basic components and functions of fluid power devices.
- Differentiate between the characteristics of pneumatic and hydraulic systems.
- Distinguish between hydrodynamic and hydrostatic systems.
- Design, create, and test a hydraulic device.
- Design, create, and test a pneumatic device.
- Calculate values in a fluid power system utilizing Pascal's Law.
- Distinguish between pressure and absolute pressure.
- Distinguish between temperature and absolute temperature.
- Calculate values in a pneumatic system, utilizing the perfect gas laws.
- Calculate flow rate, flow velocity, and mechanical advantage in a hydraulic system.

Design Problem – Control Systems
Concepts Addressed in Lesson:

- Design problems can be solved by individuals or in teams.
- Engineers use a design process to create solutions to existing problems.
- Design briefs are used to identify the problem specifications and to establish project constraints.
- Teamwork requires constant communication to achieve the desired goal.
- Design teams conduct research to develop their knowledge base, stimulate creative ideas, and make informed decisions.

Performance Objectives Addressed in Lesson:

It is expected that students will:

- Brainstorm and sketch possible solutions to an existing design problem.
- Create a decision-making matrix for a design problem.
- Select an approach that meets or satisfies the constraints provided in a design brief.
- Create a detailed pictorial sketch or use 3D modeling software to document the best choice, based upon the design team's decision matrix.
- Present a workable solution to the design problem.

Statistics and Kinematics

Statistics
Concepts Addressed in Lesson:

- Engineers use statistics to make informed decisions based upon established principles.
- Visual representations of data analyses allow for easy distribution and understanding of data.
- Statistics is based upon both theoretical and experimental data analysis.

Performance Objectives Addressed in Lesson:

It is expected that students will:

- Calculate the theoretical probability that an event will occur.
- Calculate the experimental frequency distribution of an event occurring.
- Apply the Bernoulli process to events that only have two distinct possible outcomes.
- Apply AND, OR, and NOT logic to probability.
- Apply Bayes' theorem to calculate the probability of multiple events occurring.
- Create a histogram to illustrate frequency distribution.
- Calculate the central tendency of a data array, including mean, median, and mode.
- Calculate data variation, including range, standard deviation, and variance.

Kinematics
Concepts Addressed in Lesson:

- When working with bodies in motion, engineers must be able to differentiate and calculate distance, displacement, speed, velocity, and acceleration.
- When air resistance is not taken into account, released objects will experience acceleration due to gravity, also known as freefall.
- Projectile motion can be predicted and controlled using kinematics equations.
- When a projectile is launched, velocity in the x direction remains constant; whereas, with time, the velocity in the Y direction in magnitude and direction changes due to gravity.

Performance Objectives Addressed in Lesson:

It is expected that students will:

- Calculate distance, displacement, speed, velocity, and acceleration from data.
- Design, build, and test a vehicle that stores and releases potential energy for propulsion.
- Calculate acceleration due to gravity given data from a free fall device.
- Calculate the X and Y components of a projectile motion.
- Determine the angle needed to launch a projectile a specific range given the projectile's initial velocity.

Design Problem – Statistics and Kinematics
Concepts Addressed in Lesson:

- Design problems can be solved by individuals or in teams.
- Engineers use a design process to create solutions to existing problems.
- Design briefs are used to identify the problem specifications and establish project constraints.
- Teamwork requires constant communication to achieve the desired goal.
- Design teams conduct research to develop their knowledge base, stimulate creative ideas, and make informed decisions.

Performance Objectives Addressed in Lesson:

It is expected that students will:

- Brainstorm and sketch possible solutions to an existing design problem.
- Create a decision-making matrix for their design problem.
- Select an approach that meets or satisfies the constraints provided in a design brief.
- Create a detailed pictorial sketch or use 3D modeling software to document the best choice, based upon the design team's decision matrix.
- Present a workable solution to the design problem.

Evaluation

End of course assessment administered through PLTW, college credit available. The following grade scale will be used:

A = 100-90
B = 89-80
C = 79-70
D = 69-60
F = 59-below

The student will have one semester to complete this course. Students will participate in class discussion, make presentations, effectively demonstrate physical skills, and pass written tests.

Makeup work policies: *All* work missed due to an ***excused*** absence, including school activity, must be turned in within three (3) school days of the date of absence in order to receive full credit. The student must make arrangements with the instructor, in advance if possible, to schedule make-up work due to an extended absence situation.

Curriculum Resources

Project Lead The Way, www.pltw.org

eoc tech

Digital Electronics Course Description

Digital Electronics™ is the study of electronic circuits that are used to process and control digital signals. In contrast to analog electronics, where information is represented by a continuously varying voltage, digital signals are represented by two discreet votages or logic levels. The distinction allows for greater signal speed and storage capabilities and has revolutionized the world of electronics. Digital electronics is the foundation of all modern electronic devices such as cellular phones, MP3 players, laptop computers, digital cameras, high definition televisions, etc.

The major focus of the DE course is to expose students to the design process of combinational and sequential logic design, teamwork, communication methods, engineering standards, and technical documentation.

Utilizing the activity-project-problem- based (APPB) teaching and learning pedagogy, students will analyze, design and build digital electronic circuits. While implementing these designs students will continually hone their interpersonal skills, creative abilities and understanding of the design process.

Digital Electronics™ (DE) is a high school level course that is appropriate for 10th or 11th grade students interested in electronics. Other than their concurrent enrollment in college preparatory mathematics and science courses, this course assumes no previous knowledge.

Digital Electronics™ is on of three foundation courses in the Project Lead The Way® high school pre-engineering program. The course applies and concurrently develops secondary level knowledge and skills in mathematics, science, and technology.

The course of study includes:

- Foundations of Digital Electronics
    - Scientific and Engineering Notations
    - Electronic Component Identification
    - Basic Soldering and PCB Construction
    - Electron Theory & Circuit Theory Laws
    - Circuit Simulation
    - Breadboard Prototyping
    - Component Datasheets & Troubleshooting
- Combinational Logic Analysis and Design
    - Binary, Octal and Hexadecimal Number Systems
    - Boolean Algebra and DeMorgan's Theorems
    - AND-OR-INVERT, NAND Only, and NOR Only Logic Design
    - Binary Adders and Two's Complement Arithmetic
    - Combinational Logic Design with Field Programmable Gate Arrays

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Course Syllabus

Course Title: *Digital Electronics*

Description
This course is the study of electronic circuits that are used to process and control digital signals. Digital electronics is the foundation of all modern electronic devices such as cellular phones, MP3 players, laptop computers, digital cameras and high-definition televisions. The major focus of the DE course is to expose students to the process of combinational and sequential logic design, teamwork, communication methods, engineering standards and technical documentation. This course is designed for 10th or 11th grade students.

Instructor
Edward Lord
405-390-5359
elord@eoctech.org

Course Number OCAS Number	OHLAP Credit	Length	Prerequisites
ST00021 9033	No	120 Clock Hours	Introduction to Engineering Design Principles of Engineering

Objectives/Knowledge and Skills:

Fundamentals of Analog and Digital Electronics

C:\Documents and Settings\Samuel Cox\Samuel Cox\Temporary Internet Files\2007_Curriculum_folders\IED_11_15_2007\Unit_1\Lesson1_1Intro_Design_Process.htm**Foundations and the Board Game Counter**
Concepts Addressed in Lesson:

- Safety is an important concept that must be considered for the safety of the individual, class, and overall environment of the classroom/laboratory.
- Electricity, even at the nominal levels used in this curriculum, can cause bodily harm or even death.
- Engineers and technicians use scientific notation, engineering notation, and Systems International (SI) notation to conveniently write very large or very small numbers frequently encountered when working with electronics.
- Manufacturers of resistors and capacitors use an accepted industry standard to label the nominal value of resistors and capacitors.
- Soldering is the process of joining two metal surfaces together to form an electrical connection. Soldering is used extensively in the assembly of electronic components.
- The ability to properly solder electronic components and recognition of improper solder connections is an important skill for engineers and technicians.

Introduction to Analog
Concepts Addressed in Lesson:

- Analog and digital signals have different waveforms with distinctive characteristics.
- Digital signals have two well-defined voltage levels, one for a logic high and one for a logic low.
- Analog signals have an infinite number of voltage levels that vary continuously over the voltage range for that particular system.
- The atomic structure of a material determines whether it is a conductor, an insulator, or a semiconductor.
- An understanding of the basics of electricity requires the understanding of three fundamental concepts of voltage, current, and resistance

- Engineers and technicians use Circuit Design Software as a tool to verify functionality of their analog and digital designs.

Introduction to Digital
Concepts Addressed in Lesson:

- The manufacturer datasheet contains a logic gate's general description, connection diagram, and function table.
- Integrated circuits are categorized by their underlying circuitry, scale of integration, and packaging style.
- Transistor-Transistor Logic (TTL) gates are available in a series of sub-families, each having their own advantages and disadvantages related to speed and power.
- Logic gates are depicted by their schematic symbol, logic expression, and truth table.
- The input and output values of combinational and sequential logic function differently.
- Combinational logic designs implemented with AND gates, OR gates, and INVERTER gates are referred to as AOI designs.
- The flip-flop is the fundamental building block of sequential logic.

Combinational Logic

Introduction to AOI Logic
Concepts Addressed in Lesson:

- An understanding of the binary number system and its relationship to the decimal number system is essential in the combinational logic design process.
- The first step in designing a combinational logic circuit is to translate a set of design specifications into a truth table.
- A truth table describes the behavior of a combinational logic design by listing all possible input combinations and the desired output for each.
- Logic expressions can be derived from a given truth table; likewise, a truth table can be constructed from a given logic expression.
- All logic expressions can be expressed in one of two forms: sum-of-products (SOP) or products of sum (POS).
- All logic expressions, whether simplified or not, can be implemented using AND, OR, & Inverter Gates.
- There is a formal design process for translating a set of design specifications into a functional combinational logic circuit.

Introduction to NAND and NOR Logic
Concepts Addressed in Lesson:

- Karnaugh Mapping is a graphical technique for simplifying logic expressions containing two, three, and four variables.
- A don't care condition is a situations where the design specifications "don't care" what the output is for one or more input conditions. Don't care conditions in K-Maps can lead to significantly simpler logic expressions and circuit implementations.
- A NAND gate is considered a universal gate because it can be used to implement an AND gate, OR gate, and an inverter gate. Any combinational logic expression can be implemented using only NAND gates.
- A NOR gate is considered a universal gate because it can be used to implement an AND gate, OR gate, and an inverter gate. Any combinational logic expression can be implemented using only NOR gates.
- There is a formal design process for translating a set of design specifications into a functional combinational logic circuit implement with NAND or NOR gates.
- Combinational logic designs implemented with NAND gates or NOR gates will typically required fewer Integrated Circuits (IC) than AOI equivalent implementations.

Date of Birth Design
Concepts Addressed in Lesson:

- Seven-segment displays are used to display the digits 0-9 as well as some alpha characters.
- The two varieties of seven-segment displays are common cathode and common anode.
- Any combinational logic expression can be implemented with AOI, NAND, or NOR logic.
- A formal design process exists for translating a set of design specifications into a functional combinational logic circuit.

Specific Comb Logic Circuits & Misc. Topics
Concepts Addressed in Lesson:

- An understanding of the hexadecimal and octal number systems and their relationship to the decimal number system is necessary for comprehension of digital electronics.
- XOR and XNOR gates can be used to implement combinational logic circuits, but their primary intended purpose is for implementing binary adder circuits.
- The addition of two binary numbers of any bit length can be accomplished by cascading one half-adder with one or more full adders.
- Multiplexer/de-multiplexer pairs are most frequently used when a single connection must be shared between multiple inputs and multiple outputs.
- Electronics displays that use multiple seven-segment display utilize de-multiplexers to significantly reduce the amount of power required to operate the display.
- Two's complement arithmetic is the most commonly used method for handling negative numbers in digital electronics.

Programmable Logic – Combinational
Concepts Addressed in Lesson:

- Engineers and technicians use Circuit Design Software to enter and synthesize digital designs into programmable logic devices.
- Programmable logic devices can be used to implement combinational logic circuits.
- Circuits implemented with programmable logic devices require significantly less wiring than discrete logic, but they typically require a dedicated printed circuit board to hold the device.
- Programmable logic devices can be used to implement any combinational logic circuits but are best suited for larger, more complex designs.

Sequential Logic

Latches & Flip-Flops
Concepts Addressed in Lesson:

- The flip-flop and transparent latch are logic devices that have the capability to store data and can act as a memory device.
- Flip-flops and transparent latches have both synchronous and asynchronous inputs.
- Flip-flops can be used to design single event detection circuits, data synchronizers, shift registers, and frequency dividers.

Asynchronous Counter
Concepts Addressed in Lesson:

- Asynchronous counters, also called ripple counters, are characterized by an external signal clocking the first flip-flop. All subsequent flip-flips are clocked by the output of the previous flip-flop.
- Asynchronous counters can be implemented using small scale integrated (SSI) and medium scale integrated (MSI) logic gates.
- Asynchronous counters can be implemented with either D or J/K flip-flops.
- Up counters, down counters, and modulus counters all can be implemented using the asynchronous counter method.

Synchronous Counters
Concepts Addressed in Lesson:

- Synchronous counters, also called parallel counters, are characterized by an external signal clocking all flip-flops simultaneously.
- Synchronous counters can be implemented using small scale integrated (SSI) and medium scale integrated (MSI) logic gates.
- Synchronous counters can be implemented with either D or J/K flip-flops.
- Up counters, down counters, and modulus counters all can be implemented using the synchronous counter method.

Introduction to State-Machine Design
Concepts Addressed in Lesson:

- A state machine is a circuit design that sequences through a set of predetermined states controlled by a clock and other input signals.
- State machines are used to control common everyday devices such as elevator doors, traffic lights, and combinational (electronics) locks.
- State machines can be implemented in one of two variations: Mealy or Moore.
- State machines can be implemented using small and medium scale integrated gates and programmable logic devices.

Microcontrollers
Introduction to Microcontrollers
Concepts Addressed in Lesson:

- Flowcharting is a powerful graphical organizer used by technicians, computer programmers, engineers, and professionals in a variety of roles and responsibilities.
- Basic programming skills include variable declaration, loops, and debugging.
- Programming languages have their own grammar, called syntax.
- Many everyday products use microcontrollers.
- Variables used in programming are declared and given a size that is expressed in binary.

Microcontrollers – Boe-Bot
Concepts Addressed in Lesson:

- Microcontrollers are used to control many everyday products like robots, garage door openers, traffic lights, and home thermostats.
- A servo motor is one that delivers continuous motion at various speeds.
- Microcontrollers can be programmed to sense and respond to outside stimuli

Boe-Bot Design Projects
Concepts Addressed in Lesson:

- Digital devices are only relevant if they can interact with the real world.
- Digital control devices are increasingly necessary for mechanical systems.
- Realistic problem solving with a control system requires the ability to interface analog inputs and outputs with a digital device.
- Microcontrollers are a practical tool for controlling a mechanical system.

Evaluation

End of course assessment administered through PLTW, college credit available. The following grade scale will be used:

A = 100-90
B = 89-80
C = 79-70
D = 69-60
F = 59-below

The student will have one semester to complete this course. Students will participate in class discussion, make presentations, effectively demonstrate physical skills, and pass written tests.

Makeup work policies: *All* work missed due to an ***excused*** absence, including school activity, must be turned in within three (3) school days of the date of absence in order to receive full credit. The student must make arrangements with the instructor, in advance if possible, to schedule make-up work due to an extended absence situation.

Curriculum Resources

Project Lead The Way, www.pltw.org

eoc tech

Course Syllabus

Eastern Oklahoma County
Technology Center
4601 N. Choctaw Rd., Choctaw, OK
390.9591 | www.eoctech.edu

Course Title: *Engineering Design and Development*

Description:

This capstone course allows students to design a solution to a technical problem of their choosing. They have the chance to eliminate one of the "Don't you hate it when…" statements of the world. This is an engineering research course in which students will work in teams to research, design, test and construct a solution to an open-ended engineering problem. The product development life cycle and a design process are used to guide and help the team to reach a solution to the problem. The team presents and defends their solution to a panel of outside reviewers at the conclusion of the course. The EDD course allows students to apply all the skills and knowledge learned in previous Project Lead The Way courses. The use of 3D design software helps students design solutions to the problem their team has chosen. This course also engages students in time management and teamwork skills, a valuable set for students in the future. This course is designed for 12th grade students.

Instructor
Edward Lord
405-390-5359
elord@eoctech.org

Course Number OCAS Number	OHLAP Credit	Length	Prerequisites
ST00022 8716	No	120 Clock Hours	Introduction to Engineering Design Principles of Engineering Digital Electronics

Objectives/Knowledge and Skills:

Introduction to Engineering Design and Development™
Concepts Addressed in Lesson:

- An informed decision-making process is a valuable tool in solving a problem.
- The ability to use technical and expository writing is an essential skill of communication.
- Technical writing involves communicating a problem and its potential solution to a particular audience.
- The use of expository writing provides the reader with facts about a subject in an informative style.
- Good project management will ensure the success of a project.
- A design process most used by engineers includes defining a problem, brainstorming, researching, identifying requirements, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype, testing, refining, making, and communicating results.
- A designer uses an engineer's notebook to chronologically document all aspects of a design project.

Problem Identification

Introduction to Problem Statement

Concepts Addressed in Lesson:

- Brainstorming is an effective technique used to generate problem statements to identified problems.
- Writing a concise problem statement is the foundation in solving problems.
- An accurately written problem statement aids in determining if the result of the engineering design and development process has solved the identified problem.

Verify and Justify the Problem
Concepts Addressed in Lesson:

- An accurately written problem statement identifies a need and guides the design process that will be used in engineering design problems.
- Experts are professionals that guide the research needed for accurate justification and solutions to design problems.

Research

Research and Development
Concepts Addressed in Lesson:

- Research refers to the advancement of knowledge and development refers to the application of knowledge.
- Market research aids business and industry in making better decisions about the development and marketing of new products.

Investigate Current and Past Solutions
Concepts Addressed in Lesson:

- A patent is a legally binding agreement between an inventor, owner, and the people of the United States that grants the exclusive right to produce and sell an invention or innovation for a certain length of time.
- Securing a patent involves a series of steps that must be followed.
- Research is used to investigate what solutions exist to a technical problem and if an innovation or new invention is warranted.

Invent or Innovate
Concepts Addressed in Lesson:

- Engineers design solutions to technical problems that may be an invention, something new, or they may be an innovation, a modification of an already existing solution.
- Inventions and innovations are the results of specific, goal-directed research.
- Creative thinking and economic and cultural influences shape the development of solutions to technical problems.
- The use of assessment techniques, such as trend analysis, provides information to determine if a solution should be pursued to design and development.

Decision Process

Defining Product Specifications
Concepts Addressed in Lesson:

- Specifications for a design solution enhance creativity by identifying the criteria and constraints of the design process.
- Engineers use a decision matrix to evaluate the preliminary design solution by implementing multiple parameters.
- The use of optimization improves the final design solution by justifying the specifications applied.

Design

Sketching and Technical Drawings
Concepts Addressed in Lesson:

- The use of symbols and drawings promotes clear communication of a design solution.
- Drawings and sketches are used to organize, record, and communicate ideas to experts.
- Engineers use working drawings to show all the information needed to make a single part, subassembly, or a complete design solution.
- Technical drawings are used to evaluate design solutions for any necessary refinements.

Build

Building a Prototype

Concepts Addressed in Lesson:

- The use of tool machine safety allows engineers to prevent accidents during the construction of the prototype.
- Engineers write step-by-step instructions for the prototype assembly to guide the fabrication of the design solution.
- Availability of materials and equipment is determined by using a materials and cost analysis during the prototyping phase of a project.
- Prototyping provides the engineer with a scaled working model of the design solution.

Test

Test Method
Concepts Addressed in Lesson:

- Specific criteria for success or failure of a test must be determined before testing commences.
- Prototype testing is a controlled procedure that is used to evaluate a specific aspect of a design solution.
- The results of prototype testing are used to refine the design and to improve the design solution.

Test Designed Solution
Concepts Addressed in Lesson:

- Engineers write a detailed description of the testing procedure to ensure the testing of the design solution is valid.
- Evaluation of the test results allows engineers to determine if the test is accurate and repeatable.

Presentation

Project Documentation
Concepts Addressed in Lesson:

- The use of PowerPoint® allows engineers to present visual aids and project information in a professional manner.
- Engineers use a technical report to provide thorough communication of all aspects of a design solution.
- Various media formats are chosen to effectively communicate the design solution process to a target audience.

Juried Presentation
Concepts Addressed in Lesson:

- Engineers develop skills in public speaking to effectively communicate their design solutions.

- Computerized visual presentations are used to emphasize the content of the engineer's design process.
- Presentations and displays of work provide the means to effectively promote the implementation of a project.
- A well-done presentation will enhance the quality work of a team's project.
- Resumes are used by engineers to promote their knowledge and skills when searching for employment.

Curriculum content has been developed by Project Lead The Way (PLTW) and cross-walked with the following standards:

- National Academy of Sciences
- National Council of Teachers of Mathematics
- International Technology Education Association
- National English Language Arts

Complete course content available through Project Lead The Way. www.PLTW.org

Evaluation

End of course assessment administered through PLTW, college credit available. The following grade scale will be used:

A = 100-90
B = 89-80
C = 79-70
D = 69-60
F = 59-below

The student will have one school year to complete this course. Students will participate in class discussion, make presentations, effectively demonstrate physical skills, and pass written tests.

Makeup work policies: *All* work missed due to an ***excused*** absence, including school activity, must be turned in within three (3) school days of the date of absence in order to receive full credit. The student must make arrangements with the instructor, in advance if possible, to schedule make-up work due to an extended absence situation.

Curriculum Resources

Project Lead The Way, www.pltw.org

Biotechnical Engineering (BE) Course Description

The major focus of the Biotechnical Engineering™ (BE) course is to expose students to the diverse fields of biotechnology including biomedical engineering, bio-molecular genetics, bioprocess engineering, and agricultural and environmental engineering. Lessons engage students in engineering design problems that can be accomplished in a high school setting related to biomechanics, cardiovascular engineering, genetic engineering, agricultural biotechnology, tissue engineering, biomedical devices, human interface, bioprocesses, forensics, and bio-ethics.

The BE course is a high school course that may be taken by 11th or 12th grade students as part of the Project Lead the Way® sequence of courses or as an elective. Students have experience in biology, chemistry, mathematics, and technology education. It is a project as well as problem-based curriculum similar to all Project Lead The Way® courses. Students in this course will apply biological and engineering concepts to design materials and processes that directly measure, repair, improve, and extend living systems.

Biotechnical Engineering™ is on of the specialty courses in the Project Lead The Way® pre-engineering curriculum, which applies and concurrently develops secondary level knowledge and skills in biology, physics, technology, and mathematics.

The course of study includes:

- Safety and Documentation Review
- Introduction to Biotechnical Engineering
- Biochemical Engineering
- Environmental and Agricultural Engineering
- Biomedical

Course Title: *Biotechnical Engineering*

Description

The major focus of this course is to expose students to the diverse fields of biotechnology including biomedical engineering, molecular genetics, bioprocess engineering, and agricultural and environmental engineering. Lessons engage students in engineering design problems related to biomechanics, cardiovascular engineering, genetic engineering, agricultural biotechnology, tissue engineering, biomedical devices, forensics and bioethics. Students in this course apply biological and engineering concepts to design materials and processes that directly measure, repair, improve and extend living systems. The BE course is designed for 11th or 12th grade students.

Instructor
Edward Lord
405-390-5359
elord@eoctech.org

Course Number OCAS Number	OHLAP Credit	Length	Prerequisites
ST00014 8714	No	120 Clock Hours	Biology, Chemistry, Algebra I, Algebra II

Objectives/Knowledge and Skills:

Safety and Documentation Review
Biotechnical Engineering Procedures
Concepts Addressed in Lesson:

- Project documentation is necessary to solve complex design problems and provide accurate communication.
- Journals are used to document communication and the entire design process.
- It is critical that lab instruments are giving reliable results (precise) and are representative (accurate) of what they are supposed to measure.
- Workers in a biotechnical laboratory must follow safety procedures to protect themselves and others.

Introduction to Biotechnical Engineering
Biotechnical Engineering History and Industry
Concepts Addressed in Lesson:

- Biotechnical engineering involves the application of biological and engineering concepts in order to design materials and processes that directly measure, repair, improve, and extend living systems.
- Historically, the use of engineering concepts has aided scientists to further their knowledge of biological information and engineers by using scientific principles to enhance their design solutions.
- The rapid rate of new biological discoveries is due in a large part to scientists' knowledge and their use of engineering concepts.
- The fields of biotechnology are interconnectedby the common elements of living organisms.
- There is a correlation between what is happening in the financial markets and what drives the biotechnology industry.

Lessons from Prometheus
Concepts Addressed in Lesson:

- Technology in the life sciences cannot be studied without considering the impact of new technologies and the potential to benefit or harm living systems.
- In order to make policy decisions regarding bioethics, it is important to understand what variables shape one's ethics and how those variables are distributed in society.
- Due to the controversial nature of bioethical issues, they generally pose questions that have no clear-cut easy answers.
- Bioethical issues involve questions of responsibility and obligations to others; such as, doing what is right involves reflecting on one's values, moral principles, and self-image.
- Making decisions about the use of technology involves weighing the trade-offs between the positive and negative effects.
- Consequences of actions need to be considered for the individual, for others, and for society as a whole.

Biochemical Engineering
CSI Forensics: Engineers Needed
Concepts Addressed in Lesson:
- Engineers provide the technological advances necessary for the identification and processing of DNA.
- Advances in the techniques of DNA sequence analysis and DNA amplification has revolutionized medicine and forensic science.
- The wealth of DNA sequence information that has recently been achieved has led to the development of a new field in biotechnology called bioinformatics.
- The ability to rapidly perform comparative analysis pathology data and large databases of genetic information can potentially save lives and prevent human suffering.

Environmental and Agricultural Engineering
Grow to Go
Concepts Addressed in Lesson:
- Whole organisms can be used as bioreactors to produce useful products instead of practicing complex synthetic approaches in the laboratory.
- Chemostats are important tools of process engineers that require aseptic techniques and a thorough understanding of microbial metabolism.
- Optimization of reactants or substrates is critical for efficient use of bioreactors.
- Bioprocessing can lead to novel approaches of renewable energy.

Biomedical
Biomedical Engineering
Concepts Addressed in Lesson:
- Extensive and detailed engineering plans exist to better assist professionals at work.
- Continued product evaluation must exist to improve equipment and meet the needs of patients.
- Extensive communication and documentation are essential throughout the team of professionals.
- Continued education must exist in order to advance with changes in technology.

Orthopedics
Concepts Addressed in Lesson:
- The human musculo-skeletal anatomy is the primary support system in the human body.
- The human skeletal system has five functions that affect the quality of human life.
- Common disorders of the human musculo-skeletal anatomy can be overcome by use of artificial orthopedic devices.
- A variety of specialized materials can be used for joint replacement devices.

Cardiovascular Devices and Imaging
Concepts Addressed in Lesson:

- Normal cardiac function can be accurately measured and abnormal cardiac functions can be diagnosed using a medical tool called an ECG.
- Some cardiac defects can be corrected using prosthetic devices such as heart valves or stents.
- The heart is an electrical as well as a mechanical organ which produces electrical fields that can be measured.
- Electrical signals correspond to the cardiac cycle.

Evaluation

End of course assessment administered through PLTW, college credit available. The following grade scale will be used:

A = 100-90
B = 89-80
C = 79-70
D = 69-60
F = 59-below

The student will have one semester to complete this course. Students will participate in class discussion, make presentations, effectively demonstrate physical skills, and pass written tests.

Makeup work policies: *All* work missed due to an ***excused*** absence, including school activity, must be turned in within three (3) school days of the date of absence in order to receive full credit. The student must make arrangements with the instructor, in advance if possible, to schedule make-up work due to an extended absence situation.

Curriculum Resources

Project Lead The Way, www.pltw.org

Aerospace Engineering Description

The major focus of the Aerospace Engineering™ (AE) course is to expose students to the world of aeronautics, flight, and engineering. Students will be introduced to the Project Lead The Way® activity-based, project-based, and problem-based learning through exploring the world of aerospace engineering. They will employ engineering and scientific concepts in the solution of aerospace problems. The entire curriculum sequence will include experiences from the diverse fields of Aeronautics, Aerospace Engineering™, and related areas of study. Lessons will engage students in engineering design problems related to aerospace information systems, astronautics, rocketry, propulsion, the physics of space science, space life sciences, the biology of space science, principles of aeronautics, structures and materials, and systems engineering.

The AE course is intended to serve as a specialization course within the Project Lead The Way® sequence. The course is structured to enable all students to have a variety of experiences that will provide an overview of the field. Students work in teams, exploring hands-on projects and activities to learn the characteristics of aerospace engineering and work on major problems to be exposed to the various situations that aerospace engineers face in their careers.

In addition, students use Inventor, which is state of the art 3D design software package from AutoDesk, to help them design solutions to solve proposed problems. Students design intelligent vehicles and learn about documenting their project, solving problems, and communicating their solutions to their peers and members of the professional community.

The course of study includes:

- Overview of Aerospace Engineering™
- Aerodynamics and Aerodynamics Testing
- Flight Systems
- Astronautics
- Space Life Sciences
- Aerospace Materials
- Systems Engineering

Eastern Oklahoma County
Technology Center
4601 N. Choctaw Rd., Choctaw, OK
390.9591 | www.eoctech.edu

Course Title: *Aerospace Engineering*

Description

The major focus of this course is to expose students to the world of aeronautics, flight and engineering through the fields of aeronautics, aerospace engineering and related areas of study. Lessons engage students in engineering design problems related to aerospace information systems, astronautics, rocketry, propulsion, the physics of space science, space life sciences, the biology of space science, principles of aeronautics, structures and materials, and systems engineering. Students work in teams utilizing hands-on activities, projects and problems and are exposed to various situations faced by aerospace engineers. In addition, students use 3D design software to help design solutions to proposed problems. Students design intelligent vehicles to learn about documenting their project, solving problems and communicating their solutions to their peers and members of the professional community. This course is designed for 11th or 12th grade students.

Instructor

Edward Lord
405-390-5359
elord@eoctech.org

Course Number OCAS Number	OHLAP Credit	Length	Prerequisites
ST00013 8715	No	120 Clock Hours	Introduction to Engineering Design Principles of Engineering Digital Electronics

Objectives/Knowledge and Skills:

Overview of Aerospace Engineering™

History of Flight
Concepts Addressed in Lesson:

- Knowledge of the history of flight enables an appreciation and understanding of past engineering accomplishments to be recognized.
- Knowledge of aerospace history provides insight to future challenges involving travel through the atmosphere and space.
- Many types of vehicles have been designed to fly.
- Airplanes consist of several major components each of which has a specific function in the design and operation of the airplane.
- The forces acting on an aircraft enable it to fly.

Aerodynamics and Aerodynamics Testing

Aerodynamics
Concepts Addressed in Lesson:

- The forces applied to an airplane in flight are lift, weight, drag, and thrust.
- Wings provide the lifting forces needed to overcome the weight of an airplane.
- Engines provide the thrust force needed to overcome the aerodynamic drag from the body of an airplane.
- The design of an aircraft wing requires knowledge of aerodynamics and physics.
- The design process involves the use of computer simulation tools to predict the performance of a design prior to the building of a physical model.
- The design process involves creating multiple solutions to a problem and then evaluating and ranking the solutions in order select the best solution.

Airfoil Construction
Concepts Addressed in Lesson:

- Design ideas are verified by the construction and testing of prototypes and models.
- Sub-scale models are used to represent a full size system.
- Coordinate geometry is used to create varied shapes, such as airfoils.
- Basic hand tools and equipment can be used to create accurate scale models.

Wind Tunnel Testing
Concepts Addressed in Lesson:

- Testing prototypes is an important part of the design process.
- Engineers use scaled models to evaluate, to test, and to determine the performance of their designs.
- Test results are best analyzed through the use of graphs and other methods to depict the data collected during testing.

Introduction to Propulsion
Concepts Addressed in Lesson:

- Newton's Three Laws of Motion are central to the idea of propulsion.
- An external force is required to change the state of an object from rest to motion and from motion to rest.
- The direction of acceleration is the same as the direction of the external force.
- Newton's Third Law of Motion can be used to explain the production of thrust by a propulsion system.
- The three principal propulsion systems are the propeller, the jet engine, and the rocket engine.

Flight Systems

Glider Design, Construction, and Test
Concepts Addressed in Lesson:

- Aircraft designs are the result of the best available theories, knowledge, and skills available to the designer at the time of their creation.
- Software utilizing the mathematics of flight theory can be used to predict the flight performance of an aircraft prior to its construction.
- Construction of a multi-component device is aided by the use of assembly and alignment jigs.
- Flight testing data is essential for evaluating an aircraft design.
- Radically different designs can achieve similar results.

GPS and Spatial Awareness

- Pilots need to know where they are and how to proceed to the next waypoint in their flight plan.
- Flight safety requires spatial awareness.
- Numerous methods have been used to communicate positional information to pilots using old, current, and cutting edge technology to improve flight safety through redundancy.
- Global Positioning Systems use information provided by a constellation of satellites to calculate a position and motion in all three axes and through time.
- Location and motion information is tremendously enhanced when it is correlated to 2D and 3D representations of the world around a pilot.

Astronautics

Measuring Rocket Engine Thrust
Concepts Addressed in Lesson:

- Rocket thrust can be measured using a simple device.
- Calibration of a thrust measurement device can provide accurate data.
- Thrust vs. time data can be acquired using a strip chart recorder.
- Rocket thrust must be controlled to reduce the damaging effects of traveling through dense atmosphere.

Model Rocket Trajectory
Concepts Addressed in Lesson:

- Parts of a model rocket and parts of a model rocket engine have specific function(s) during a rocket's flight.
- The forces of weight, thrust, drag, and lift interact differently on a rocket in flight than on an aircraft in flight.
- Newton's three laws of motion (inertia, F = ma, and action-reaction) can be used to describe and predict events during each phase of a rocket launch.
- Rocket design features are interrelated and determine how well a rocket will perform during powered flight.
- The maximum velocity and maximum acceleration of a rocket during flight can be calculated mathematically given model rocket and engine performance data.
- A rocket's maximum altitude can be calculated by using indirect measurement.

Rocket Camera
Concepts Addressed in Lesson:

- The Internet and the library are useful tools for conducting research.
- Aerial photography has many applications.
- Using the scientific method to design a project to answer a research question is an important skill to conducting a scientific/engineering investigation.
- Formulating a research question based on research, gathering data, analyzing data, and making judgments about experimental data are vital processes for conducting a research project/an investigation.
- The scale factor of aerial photographs can be used to determine a rocket's altitude, number, and kind of objects in the photograph, and the dimension of objects in the photographs.
- Aerial photographs can be used to identify, classify, and enumerate objects in the photograph.
- A rocket's launch angle affects the forces of lift, thrust, weight, and drag.

Orbital Mechanics
Concepts Addressed in Lesson:

- Ellipses are conic sections, and circles are special cases of ellipses.
- Orbits involve the steady procession of a small mass object around a large mass object. This includes planets processing around the sun, as well as satellites processing around a planet.
- Objects in orbit are continuously "falling" toward the body about around which they orbit.
- Orbital elements can be used to fully define a satellite's orbit, allowing the accurate prediction of the precise location of the satellite at a given time.
- Orbital mechanics provides a means for describing orbital behavior of bodies.

Space Life Sciences

Life Support and Environmental Systems
Concepts Addressed in Lesson:

- Basic physiological needs of the human body when living safely within and outside of Earth's atmosphere are oxygen, pressure, food and water, sleep, gravity, temperature, protective clothing, voiding by bladder and bowel.
- The environment on earth and in space must be considered when designing solutions to problems in aerospace engineering.

- Engineers have solved many technological challenges faced when designing solutions for living higher atmospheres and space.
- The force, mass, and acceleration phenomena or G-forces that astronauts, fighter pilots, and Formula One drivers might experience is because of the rocket, jet, or internal combustion engine that provides the force needed to accelerate them, not gravity.

Effect of Gravity on the Human Body
Concepts Addressed in Lesson:

- Reduced gravity environments can be simulated in a 1-g, Earth-normal, environment.
- The action of spinning can fool the senses and stimulate the vestibular system in the inner ear.
- An increase stress-filled environment is physically unique and can affect the ability to perform mental functions.
- Cooperative and supportive team behaviors result in increased safety and higher quality data.

Microgravity Drop Tower
Concepts Addressed in Lesson:

- Gravity is the weakest force known in nature, yet it holds galaxies and the solar system together.
- Any object in freefall experiences microgravity conditions, which occur when the object falls toward the Earth with an acceleration equal to that due to gravity alone (approximately 9.8 meters per second squared [m/s2], or 1 g at Earth's surface).
- Brief periods of microgravity can be achieved on Earth by dropping objects from tall structures.
- The microgravity environment associated with the space shuttle is a result of the spacecraft being in orbit, which is a state of continuous freefall around the Earth.
- A microgravity environment gives researchers a unique opportunity to isolate and study the influence of gravity on physical processes, as well as phenomena that are normally masked by gravity and thus difficult, if not impossible, to study on Earth.

Aerospace Materials

Composites Fabrication and Testing
Concepts Addressed in Lesson:

- Multiple layers of any material are stronger than a single layer of that material.
- Composite materials are fabricated by molding together layers of reinforced fabric, such as often glass or carbon fiber with a plastic matrix, such as epoxy.
- Composite materials are used in the aerospace industry because they have excellent strength to weight ratios, which means they are able to carry large loads with a lighter structure.
- The strength and stiffness of composite materials can be significantly increased by altering the distance between adjacent sheets using a core material to create a sandwich construction.
- Material performance is sometimes assessed by comparing strength to weight ratios.
- A deflection test can be used to accurately determine the modulus of elasticity of a composite plastic sample.
- A deflection test can be used to indicate the stiffness of various composite plastic samples.

Thermal Protection Systems for Space Vehicles
Concepts Addressed in Lesson:

- An understanding of the physics of space vehicle re-entry into the atmosphere is important for designing thermal protection systems.
- Knowledge of material properties and testing is essential when trying to protect a space vehicle.
- Heat transfer is a process that creates high temperatures in a space vehicle.
- Energy is dissipated and converted into heat during a space vehicle re-entry.
- Thermal Protection Systems (TPS) consist of various materials and coatings that are designed to protect a space vehicle.

Systems Engineering

Intelligent Vehicles
Concepts Addressed in Lesson:

- The two incentives for building robots are social, replacing humans in undesirable or dangerous jobs, and economic, reducing the cost of manufacturing while improving its quality.
- Interactive systems are used in complicated arenas, such as science exploration.
- Electronic data communication allows information to be transferred from human to human, human to machine, machine to human, and machine-to-machine.
- The determination of the pH (potential of Hydrogen) of an unknown substance or substances aids in identifying the substance.
- Robotic devices must be designed to perform effectively in the environment in which they will be used.
- Robotic devices are composed of mechanical, electrical, and computer based systems that can be programmed to make decisions and control actions based upon sensor readings.
- The fundamental challenge when working in robotics is deciding what motions the robot should perform in order to achieve a goal.

Evaluation

End of course assessment administered through PLTW. The following grade scale will be used:

A = 100-90
B = 89-80
C = 79-70
D = 69-60
F = 59-below

The student will have one semester year to complete this course. Students will participate in class discussion, make presentations, effectively demonstrate physical skills, and pass written tests.
Makeup work policies: *All* work missed due to an ***excused*** absence, including school activity, must be turned in within three (3) school days of the date of absence in order to receive full credit. The student must make arrangements with the instructor, in advance if possible, to schedule make-up work due to an extended absence situation.

Curriculum Resources

Internet is required for this course.
Complete course content available through Project Lead The Way.

Project Lead The Way, www.pltw.org

Civil Engineering & Architecture (PLTW) Course Description

Pre-Engineering & Architecture – Students in this major will study pre-engineering through Project Lead The Way curriculum that will introduce them to the concepts and principles of engineering and there will be strong emphasis on developing problem solving skills. The will learn how engineers use math, science and technology to solve problems. Students in this major will also complete a course that will focus on civil and architecture engineering that will focus on project planning, site planning, and building design. Students will also complete advanced math and science courses, including physics and calculus, which will prepare them to advance to the college or university level.

eoc tech

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Course Syllabus

Course Title: *Civil Engineering & Architecture (PLTW)*

Description
The major focus of the Civil Engineering and Architecture (CEA) course is a long-term project that involves the development of a local property site. As students learn about various aspects of civil engineering and architecture, they apply what they learn to the design and development of this property. The course provides freedom to the teacher and students to develop the property as a simulation or to students to model the real-world experiences that civil engineers and architects experience when developing property.

The CEA course is intended to server as a specialization course within the Engineering Academy sequence. The course is structured to enable all students to have a variety of experiences that will provide an overview of both fields. Students work in teams, exploring hands-on projects and activities to learn the characteristics of civil engineering and architecture.

In addition, students use Rivet, which is a state of the art 3-D design software package from AutoDesk, to help them design solutions to solve their major course project. Students learn about documenting their project, solving problems, and communicating their solutions to their peers and members of the professional community of civil engineering and architecture. This course can be taken concurrently with Digital Electronics and articulates for college credit. (Prerequisite: Introduction to Engineering Design and Principles of Engineering)

Approved Course Materials and Resources:
Land Development Handbook, Glencoe McGraw-Hill
Architectural Drafting and Design, Delmar Thomson
*Instructional videos limited to no more than six hours each semester

Course Expectations:
Students will demonstrate:
- an ability to apply knowledge of mathematics, science, and engineering
- an ability to design and conduct experiments, as well as to analyze and interpret data
- an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- an ability to function on multi-disciplinary teams
- an ability to identify, formulate, and solve engineering problems
- an understanding of professional and ethical responsibility
- an ability to communicate effectively
- the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- a recognition of the need for, and an ability to engage in life-long learning
- a knowledge of contemporary issues
- an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
- an ability to read at least 100 pages of technical reading

Sample Course Activities/Projects/Assessments:

- Long-term project developing a property site
- Engineering log
- Problem solving activities
- Project presentations
- 3-D Design software applications

Course Outline:

Unit 1: Overview of Civil Engineering and Architecture

Lesson 1.1: Civil Engineering and Architecture Overview

1.1.1 Civil Engineering
1.1.2 Architecture
1.1.3 Historical implications
1.1.4 Introduction to Roles of All Players/Stakeholders
1.1.5 Responsibilities and ethics

Unit 2: Introduction to Projects

Lesson2.1: Overview of Project Design

2.1.1 Purpose
2.1.2 Design Project Scenario (snapshot program requirements and teaming)

Lesson 2.2: Project Documentation

2.2.1 Portfolio Components
2.2.2 Sketching
2.2.3 Journals
2.2.4 Specifications Manual
2.2.5 Working Drawings

Unit 3: Project Planning

Lesson 3.1: Site Information

3.1.1 Site Selection
3.1.1.1 History of Site
3.1.1.2 Site Visit
3.1.1.3 Identify Neighboring Properties
3.1.1.4 Suitability of the site

3.1.2 Regulations
3.1.2.1 Municipal Regulations
3.1.2.2 Archaeological Considerations
3.1.2.3 Environmental Limitations
3.1.2.4 Covenants, Deed, and Zoning Restrictions

3.1.3 Viability Analysis
3.1.3.1 Surroundings
3.1.3.2 Infrastructure
3.1.3.3 Traffic Flow Analysis
3.1.3.4 Utilities
3.1.3.5 Local considerations/constraints—neighbors, zoning
3.1.3.6 Lot Size

Lesson 3.2: Development Options, Selection of Project, and Revisiting Viability Analysis

3.2.1 Development
3.2.2 Residential
3.2.3 Commercial
3.2.4 Industrial

3.2.5 Public/Private Assembly Places
3.2.6 Plan Unit Development (PUD)

Unit 4: Site Planning

Lesson 4.1: Description of Property
- 4.1.1 Surveying
- 4.1.2 Maps
- 4.1.3 Metes and Bounds System
- 4.1.4 Lot and Block System

Lesson 4.2: Site Plan Requirements
- 4.2.1 Topography
- 4.2.2 Number of Spaces
- 4.2.3 Types of Spaces
- 4.2.4 Sizes of Spaces
- 4.2.5 Activities in Spaces
- 4.2.6 Amenities
- 4.2.7 Special Needs
- 4.2.8 Support Facilities
- 4.2.9 Detached Buildings

Lesson 4.3: Site Plan Layout
- 4.3.1 Wetland Identification and Protection
- 4.3.2 Frontage
- 4.3.3 Easements, Utility Right of Ways, Setbacks
- 4.3.4 Utility Availability and Corridors
- 4.3.5 Building Size and Orientation

Lesson 4.4: Public Ingress and Egress
- 4.4.1 Roadways
- 4.4.2 Pathways
- 4.4.3 Sidewalks
- 4.4.4 Off-Street Parking
- 4.4.5 Signage and Markings
- 4.4.6 Lighting
- 4.4.7 Universal Access

Lesson 4.5: Site Grading
- 4.5.1 Identification of Sub-Surface Conditions
- 4.5.2 Topographic design
- 4.5.3 Top Soil
- 4.5.4 Storm Water Management
- 4.5.5 Cut and Fill Balances
- 4.5.6 Excavation

Lesson 4.6: Utilities
- 4.6.1 Water Supply
- 4.6.2 Wastewater
- 4.6.3 Electrical
- 4.6.4 Gas
- 4.6.5 Cable
- 4.6.6 Telephone

Lesson 4.7: Landscaping

- 4.7.1 Function
- 4.7.2 Green space
- 4.7.3 Xeriscape—self sufficient without need of additional water
- 4.7.4 Irrigation systems

Lesson 4.8: Water Supply and Wastewater Management

- 4.8.1 Water
- 4.8.2 Wastewater
- 4.8.3 Management methods

Unit 5: Architecture

Lesson 5.1: Architectural styles

- 5.1.1 Structural style
- 5.1.2 Building material, color, proportion, and rhythm

Lesson 5.2: Floor Plans

- 5.2.1 Arrangement of Spaces
- 5.2.2 Building Envelope
- 5.2.3 Windows
- 5.2.4 Doors
- 5.2.5 Wall Types
- 5.2.6 Floor Types
- 5.2.7 Equipment Layout
- 5.2.8 Universal Accessibility
- 5.2.9 Vertical transport

Lesson 5.3: Energy Systems

- 5.3.1 Minimum Code Requirements
- 5.3.2 Green Building Options
- 5.3.3 Smart Building Technologies
- 5.3.4 Utility Cost Analysis
- 5.3.5 Emerging Custom Measures

Lesson 5.4: Elevations

- 5.4.1 Exterior
- 5.4.2 Interior

Lesson 5.5 Sections and Details

- 5.5.1 Identification
- 5.5.2 Building Section
- 5.5.3 Wall Section
- 5.5.4 Construction Details

Lesson 5.6: Schedules

- 5.6.1 Door and Window Schedules
- 5.6.2 Finish Schedules

Lesson 5.7: Mechanical, Electrical, and Protection Systems

- 5.7.1 Plumbing
- 5.7.2 HVAC
- 5.7.3 Electrical systems
- 5.7.4 Power Requirements
- 5.7.5 Electrical Plan
- 5.7.6 Lighting Plan
- 5.7.7 Protection Systems

5.7.8 Fire, Smoke, and Gas Detection Systems
5.7.9 Fire Suppression Systems
5.7.10 Security Systems

Unit 6: Structural Engineering

Lesson 6.1: Introduction to Structural Engineering

6.1.1 Structural Engineering
6.1.2 Various Loads
6.1.3 Wind Loads
6.1.4 Snow Loads
6.1.5 Dead Loads
6.1.6 Live Loads

Lesson 6.2: Roof Systems

6.2.1 Materials
6.2.2 Types of trusses
6.2.3 Load Calculations for roof members
6.2.4 Architectural styles

Lesson 6.3: Columns and Beams

6.3.1 Materials
6.3.2 Loading
6.3.3 Fire Proofing
6.3.4 Connections
6.3.5 Column schedules
6.3.6 Sizing of members

Lesson 6.4: Foundations

6.4.1 Types
6.4.2 Soil Bearing Capacities
6.4.3 Drainage
6.4.4 Piers
6.4.5 Settling

Unit 7: Presentations and Reviews

Lesson 7.1: Critiques and Reviews

7.1.1 Self Assessment
7.1.2 Peer Review
7.1.3 Public Exhibit
7.1.4 Interviews
7.1.5 Competitions

Lesson 7.2: Final Presentations

7.2.1 Peer
7.2.2 School panel
7.2.3 Parents
7.2.4 School board
7.2.5 Other community groups

Course Curriculum MAP:

Unit 1: Overview of Civil Engineering & Architecture 5 Hours	**Unit 2:** Introduction to Projects 25 Hours	**Unit 3:** Project Planning 15 Hours	**Unit 4:** Site Planning 40 Hours
Unit 5: Architecture 50 Hours	**Unit 6:** Structural Engineering 20 Hours	**Unit 7:** Presentations & Reviews 20 Hours	

Lesson Protocol:

- Bell Ringer Activity: Anticipatory Activity or review of previous learning
- Teacher Input
    - Check for understanding
- Teacher Models steps/processes
    - Check for understanding
- Guided Practice: Students apply steps/processes with guidance
    - Check for understanding
- Independent Practice: Students work in teams or independently to complete project
- Closing Activity: summarize learning and final check for understanding

Course Power Vocabulary:

3D modeling
A-frame
above ground
absorption
adjacency matrix
aesthetics
alluvium
ampere
anaerobic
angle of repose
architect
architecture
arterial
aquifer
artifact
asymmetry
azimuth
barrier
bearing points
begin vertical curve (BVC)
Bentonite
berm
blueprints
bracing system
branch
bubble diagrams
caisson
cantilever
cartography
catchbasin
ceiling joist
chipboard
circuit
civil engineer
clamp screw
closed traverse
colloidal
commercial structure
complex beam
compression
conductor
continuous foundation
contour
coordinate geometry
cornice
cripple stud
critical buckling load
cross bracing
curb cut
dead load
deflection
design brief
determinant beam
Diazo reproduction
dimensions
diatomaceous earth
dispersement
distribution main
distribution panel
drip edge
ductile iron
ductwork capacity
Dutch hip
easement
eave
effluent
egress
end vertical curve (EVC)
engineered beam
environmental engineer
exterior
fascia
fiber bending stress
fine adjusting screw
fixed beam

fixed support
floating foundation
floor joist
footings
gambrel
geodetic surveying
girder
grade beam
green space
gusset
hip
holding pond
horizontal orientation
hydro geologist
hydrographic
indetermina
nt beam
ingress
jack stud
jamb
junction box
kaolin
king stud
lateral loads
line-of-sight
live loads
meridians
metes
modulus of elasticity
overhang
perspective drawings
photogrammetry
pile foundations
pitch
plat
plot plan
point of beginning (POB)
point of curve (P.C.)
point of intersection (P.I.)
point of reference (POR)
point of tangency (PT)
precast concrete
propped beam
reinforcement bars (rebar)
relief
renderings
scissor truss
seasonal wind pattern
section modulus
seismic load
septage
single beam
site orientation
soffit
soil perc test
soil pH
specification manuals
structural engineer
subfloor
swale
symmetry
tension
terrain
underground
vertical curve (VC)
vertical orientation
viability analysis
wall section
waster treatment engineering
wastewater
weatherhead
wind orientation
zenith angle
zoning

Eastern Oklahoma County Technology Center — Plan of Study

Career Cluster: Science, Technology, Engineering, and Mathematics
Pathway: Engineering and Technology
Career Major: Advanced PLTW Pre-Engineering

(FOR INCOMING SOPHOMORES 2012-2013)

Required Courses	**Hours**	**OCAS Number**	**CTE Number**	**Grade Level**	**Course Length**	**Time per period**
Principles of Engineering	120	8710	ST00024	10	1st Semester	90 minutes
Introduction to Engineering Design	120	8709	ST00023	10	2nd Semester	90 minutes
Algebra II	120	4412	ST00006	10	All year	45 minutes
Trigonometry/Pre Cal	120	4750	ST00010	10	All year	45 minutes
Pre AP Physics	120	5211	ST00011	10	All year	45 minutes
Digital Electronics	120	8712	ST00021	11	1st Semester	90 minutes
AP Physics B	120	5215	ST00063	11	All year	45 minutes
AP Calculus AB	120	4615	ST00061	11	All year	45 minutes
*Aerospace Engineering	120	8715	ST00013	11/12	2nd Semester	90 minutes
*Biotechnical Engineering	120	8714	ST00014	11/12	2nd Semester	90 minutes
*Civil Engineering and Architecture	120	8713	ST00019	11/12	2nd Semester	90 minutes
Engineering Design and Development	120	8716	ST00022	12	2nd Semester	90 minutes
*AP Calculus BC	120	4616	ST00062	12	All year	45 minutes

*AP Chemistry	120	5055	ST00007	12	All year	45 minutes
*AP Environmental Science	120	5121	ST00002	12	All year	45 minutes
*AP Physics C- Electricity & Magnetism	120	5217	ST00065	12	All year	45 minutes
*AP Physics C – Mechanics	120	5216	ST00064	12	All year	45 minutes
Total Hours	**1440**	**NOTE: Our schedule is flexible to allow extra time for labs and projects.**				

- Indicates choices the student has for that 2nd and 3rd year of the program.

Eastern Oklahoma County Technology Center   Plan of Study

Career Cluster: **Science, Technology, Engineering, and Mathematics**
Pathway: **Engineering and Technology**
Career Major: **Advanced PLTW Pre-Engineering**

(INCOMING JUNIORS 2012-2013)

Required Courses	**Hours**	**OCAS Number**	**CTE Number**	**Course Length**	**Time per period**
Principles of Engineering	120	8710	ST00024	1st Semester	90 minutes
Introduction to Engineering Design	120	8709	ST00023	2nd Semester	90 minutes
Trigonometry/Pre Cal	120	4750	ST00010	All year	45 minutes
Pre AP Physics	120	5211	ST00011	All year	45 minutes
Digital Electronics	120	8712	ST00021	1st Semester	90 minutes
AP Physics B	120	5215	ST00063	All year	45 minutes
AP Calculus AB	120	4615	ST00061	All year	45 minutes
*Aerospace Engineering	120	8715	ST00013	2nd Semester	90 minutes
*Biotechnical Engineering	120	8714	ST00014	2nd Semester	90 minutes
*Computer Integrated Manufacturing	120	8712	ST00019	2nd Semester	90 minutes
*Civil Engineering and Architecture	120	8713	ST00019	2nd Semester	90 minutes
*Engineering Design and Development	120	8716	ST00022	2nd Semester	90 minutes
Total Hours	**960**				

- Indicates choices the student has for the second year of the program

Cert#0592497

Oklahoma State Department of Education

Teaching Certificate

The State Board of Education certifies and authorizes

EDWARD W. LORD

to serve in the accredited schools of Oklahoma as indicated below.

Description	Level	Valid From	Valid To
ANATOMY/PHYSIOLOGY	6-12	3/1/2010	6/30/2015
BIOLOGY	6-12	3/1/2010	6/30/2015
BOTANY	6-12	3/1/2010	6/30/2015
CHEMISTRY	6-12	3/1/2010	6/30/2015
GENERAL SCIENCE	6-12	3/1/2010	6/30/2015
PHYSICAL SCIENCE	6-12	3/1/2010	6/30/2015
PHYSICS	6-12	3/1/2010	6/30/2015
ZOOLOGY	6-12	3/1/2010	6/30/2015
SCIENCE	6-8	3/1/2010	6/30/2015
SOCIAL STUDIES	6-8	3/1/2010	6/30/2015

**NO ENTRIES BELOW THIS LINE **

Teacher #: **200386**

Print Date: **3/30/2010**

Degree: **Bachelor's**

Class of Certification: **Standard**

Sandy Garrett

State Superintendent of Public Instruction

Certificate of Completion

PLTW 2012 Summer Training Institute

at

Oklahoma State University

Awarded to

Edward Lord

for successful completion of 80 hours of professional development

Introduction to Engineering Design
July 8-20, 2012

Vince M. Bertram, Ed.D.
President & Chief Executive Officer

PROJECT LEAD THE WAY
PLTW
Preparing students for the global economy

Brandy Mays
Oklahoma State University

8.0 CEUs as defined by the Colleges and Universities

Certificate of Completion

PLTW 2012 Summer Training Institute

at

Oklahoma State University

Awarded to

Edward Lord

for successful completion of 80 hours of professional development

Principles of Engineering
June 17-29, 2012

Vince M. Bertram

Vince M. Bertram, Ed.D.
President & Chief Executive Officer

Brandy Mays

Brandy Mays
Oklahoma State University

PROJECT LEAD THE WAY
PLTW
Preparing students for the global economy

8.0 CEUs as defined by the Colleges and Universities

PROJECT LEAD THE WAY PLTW

2012 Core Training Participant Statement of Understanding

Name: *(please print)*: Edward Lord

All participants at Project Lead The Way (PLTW) Core Training are required to maintain a portfolio of activities, projects and problems as assigned by the Core Training Instructors (CTI). The CTI will periodically review and sign-off on completed portions of the portfolio over the duration of Core Training.

The course portfolio is a collection of the selected coursework that is assigned during PLTW Core Training and provides evidence that the participant has successfully completed the material. A CTI will only initial each activity when they determine that the participant demonstrates adequate competency with the particular subject matter - not merely because it is complete. It is the intent that all of the activities on the Portfolio Checklist be completed either during the scheduled class time or as a homework exercise. Successful completion is at the sole discretion of the CTI.

Core Training provides a comprehensive overview of the course content, and is not inclusive of the full scope and breadth of the course. Due to the limited time constraints, Core Training provides only an introduction to select activities, projects, and problems within the course. In preparation to teach the course, it is the responsibility of the participant to continue to familiarize themself with the entire course curriculum upon completion of Core Training.

I understand it is my responsibility to successfully complete a course portfolio and to become competent in the full scope of the specific Project Lead The Way curriculum prior to instructing any students.

Signature: Ed L Date: 7-9-12

2012 Core Training Participant Completion Report

Participant's Name: Edward Lord
School District: EOC Tech
School Name: EOC Tech
Email Address: elord@eoctech.org
Core Training Dates: 7-8-12 7-20-12
Core Training Location: OSU
Instructor(s) Names: Todd Wallace
Dr. Nazemetz

My instructor(s) reviewed the Portfolio Checklist with me and I am aware of the final evaluation.

Signature: [signature] **Date:** 7-20-12

The student (has / has not) met the requirements of this course.

Instructor's Signature: [signature] **Date:** 7/20/2012
Instructor's Signature: [signature] **Date:** 7/20/2012

Note to CTI:

When completed, please provide a copy of the Statement of Understanding, Participant Completion Report, and the Portfolio Checklist to the participant and to the Affiliate Director.

PROJECT LEAD THE WAY
PLTW

Introduction to Engineering Design
Portfolio Checklist
2012 Summer Training Institute

Participant Name: EDWARD LORD   Instructor Name(s): Wallace

Due Date	Assignments and Deliverables	Instructor Initials
Readiness Training	Inventor 2013 Training Module # 1 Getting Started	
Readiness Training	Inventor 2013 Training Module #2 Menu & Toolbar	
Readiness Training	Inventor 2013 Training Module #3 Viewing and Navigation	
Readiness Training	Inventor 2013 Training Module # 4 Base and Arm Pin	
Readiness Training	Inventor 2013 Training Module # 5 Socket head cap screws	
Readiness Training	Inventor 2013 Training Module #6 Crank and Slides	
Readiness Training	Inventor 2013 Training Module #7 Crank Knob Guide Block	
Readiness Training	Inventor 2013 Training Module #8 Base Plate	
Readiness Training	Installation of Autodesk Inventor 2013	
Readiness Training	Download of 2012 Core Training CHM file	
Readiness Training	Purchase manual Training Module	
DAY 2	Toy .iam	
DAY 2	Toy operation .wmv video	
DAY 2	Activity 1.4 Concept Sketching	
DAY 2	Activity 1.6 Deep Dive	
DAY 3	Activity 2.1 Isometric Sketching (Questions 1 -7)	
DAY 3	Activity 2.3 Glass Box	
DAY 3	Activity 2.4 Multi-view Sketching	
DAY 3	Activity 3.5 Applied Statistics	
DAY 4	Activity 4.2 Puzzle Part Combinations	
DAY 4	Project 4.1 Puzzle Design Challenge	
DAY 5	Activity 5.3 Determining Density	

Due Date	Assignments and Deliverables	Instructor Initials
DAY 5	Activity 5.4 Calculating Properties of Solids.	
DAY 5	Activity 5.6 Mass Property Analysis	
DAY 6	Activity 7.2 Sectional Views	
DAY 6	Problem 7.7 Product Improvement	
DAY 7	Participants will begin Project 8.1a Model Button Maker or 8.1b Arbor Press or 8.1c Model a miniature Train (Instructor assigned parts)	
DAY 10	Project 9.3 Virtual Design Challenge	
DAY 9	Project 10.1 Design Challenge	

Oklahoma State Department of Education Teaching Certificate

The State Board of Education certifies and authorizes JANA R. GADDIS **to serve in the accredited schools of Oklahoma as indicated below.**

Teacher #: 120180

Degree: MASTERS 07/28/1987

Class: STANDARD

Print Date: 03/17/2008

Code	Description	Valid From M D Y / Valid To M D Y	Code	Description	Valid From M D Y / Valid To M D Y
3509	BUSINESS MATH	29607010806301З	5501	ALGEBRA	19607010806301З
5503	ANALYSIS	19607010806301З	5505	CALCULUS	19607010806301З
5509	GENERAL MATHEMATICS	19607010806301З	5511	GEOMETRY	19607010806301З
5513	LINEAR ALGEBRA	19607010806301З	5517	TRIGONOMETRY	19607010806301З

************************** NO ENTRIES BELOW THIS LINE **************************

Sandy Garrett

State Superintendent of Public Instruction