

# UCO Engineering Physics Program

Presentation to Intro to Engineering  
Fall 2009

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[www.engineering.uco.edu](http://www.engineering.uco.edu)

# UCO EP - Outline

- Physics/Applied Physics/Engineering
- EP – Definition
- EP – Majors/Options
- EP – High School Preparation
- EP – Advisement
- EP – Curriculum
- EP – Employment
- EP - Grad. School
- EP – Money
- EP Research
- Conclusions
- Questions

# Physics

*rules for the universe*

- Mechanics (Newton)
- Mech. (Einstein)
- Electromagnetism
- Quantum Mech.
- Stat. Mech

- Atomic/Molecular/Optics
- Surface
- Nuclear
- High Energy/Particle
- Astrophysics

## Applied Physics

physics which is intended for a particular technological or practical use

## Engineering

acquiring and applying scientific and technical knowledge to the design, analysis, and/or construction of works for practical purposes

- \* Accelerator physics
- \* Acoustics
- \* Agrophysics
- \* Ballistics
- \* Biophysics
- \* Computational physics
- \* Communication Physics
- \* Econophysics
- \* Engineering physics
- \* Fiber Optics
- \* Fluid dynamics
- \* Laser physics
- \* Force microscopy and imaging
- \* Geophysics
- \* Quantum electronics
- \* Medical physics
- \* Microfluidics
- \* Nanotechnology
- \* Nondestructive testing

- \* Nuclear engineering
- \* Nuclear technology
- \* Optics
- \* Optoelectronics
- \* Analog Electronics
- \* Digital Electronics
- \* Microproc. Interfacing
- \* Signals And Systems
- \* Photovoltaics
- \* Plasma physics
- \* Semicond. phys and dev
- \* Soil Physics
- \* Solid state physics
- \* Superconductors
- \* Space physics
- \* Spintronics
- \* Vehicle dynamics
- \* Metrological Physics

- \* Aerospace Engineering - The design of aircraft, spacecraft and related topics.
- \* Agricultural Engineering - The engineering principle applications in agricultural fields such as farm power and machinery, biological material process, bioenergy, farm structures as well as agricultural natural resources.
- \* Biomedical Engineering - The application of engineering principles and techniques to the medical field.
- \* Chemical Engineering - The conversion of raw materials into usable commodities.
- \* Civil Engineering - The design and construction of public and private works, such as bridges and buildings.
- \* Computer Engineering - The entire process of designing and coding comp. and comp.related devices.
- \* Comp Science or Software Engineering - The design and development of software for use in digital systems
- \* Electrical Engineering - The design of electrical systems, such as transformers, as well as electronic goods.
- \* Environmental Engineering - Environmental Engr. are concerned with protecting the environment by assessing the impact a project has on the air, water, soil and noise levels in its vicinity.
- \* Fire Protection Engineering - is the application of science and engineering principles to protect people and their environments from the destructive effects of fire and smoke.
- \* Industrial Engineering - The design and analysis of logistical and resource systems.
- \* Instrumentation engineering - The design of all electronic instruments.
- \* Mechanical engineering - The design of physical or mechanical systems, such as engines, kinematic chains, and vibration isolation equipment.
- \* Manufacturing engineering - The ability to plan the practices of manufacturing, to research and develop the tool, processes, machines and equipment, and to integrate the facilities and systems for producing quality products with optimal expenditure.
- \* Materials Engineering - an interdisciplinary field involving the properties of matter and its applications to various areas of science and engineering
- \* Mining Engineering - The extraction of raw materials from the earth, including ores, natural gases, and crude oils.
- \* Nuclear Engineering - Application of the breakdown of atomic nuclei and/or other sub-atomic physics, based on the principles of nuclear physics.

# Engineering Physics

- Def: *An interdisciplinary engineering discipline where students gain thorough grounding in applied physics and engineering science so they are able to pursue a chosen technical area (i.e. an engineering discipline or specific applied physics area).*

# EP @ UCO

- The EP Program is accredited by ABET, Inc., the US engineering program accreditation agency.
- There are three EP Majors @ UCO:
  - Engr. Phys. - Electrical Systems
  - Engr. Phys. - Mechanical Systems
  - Engr. Phys. - Physics

# EP – Electrical Systems

This major is designed for those students interested in electrical systems. The specialization courses may include courses such as *digital electronics, digital signal processing, digital and analog communication, and semiconductor devices*. Students in EP-Electrical Systems often either go directly to work as engineers in industry or attend graduate school in electrical engineering.

# EP – Mechanical Systems

This major is designed for those students interested in mechanical systems. The specialization courses may include courses such as *fluid mechanics and lab*, *strength of materials and lab*, *heat transfer and lab*, *mechanical engineering design*, and *thermal systems design*. Students in EP-Mechanical Systems often either go directly to work as engineers in industry or attend graduate school in mechanical engineering.

# EP – Physics

This major is designed for those students interested in graduate study in physics. Students may take courses such as *analytical mechanics*, *classical mechanics*, *electromagnetic fields*, *quantum mechanics*, and *photonics*. Students in Engineering Physics-Physics have gone on to graduate programs in physics, nano-materials science, and chemical physics.

# Engineering Physics

- *Technical Areas:*
  - *Mechanical, Electrical, Applied Physics areas*
  - *Optics & optoelectronics, nanotech. engr., microfluidics/nanofluidics, solid state devices, control theory, biophotonics.*
  - *Newer engineering (sometimes new emerging engineering disciplines) – cutting edge.*
  - *MS or PhD degree preparation in specific engineering discipline.*
  - *Biomedical Sciences/Engineering*
  - *Interdisciplinary – BIO 2010 – efforts to make undergrad. courses interdisciplinary.*

# High School Science Prep

- Physics (Standard or AP) are good
  - if have not taken will need *PHY 1003 Intro to Physics*
  - *PHY 2014, 2114, 3103* are required in EP
- Chem
  - *CHEM 1103 Gen. Chem I* and *CHEM 1112 Lab* are required in EP
- Other
  - Good but not required

# High School Math Prep

- If highest math was Algebra II
  - Might start with *MATH 1513 College Algebra*
- If highest math was Math Analysis
  - Might start with *MATH 1593 Trigonometry*
- If highest math was Trigonometry
  - Might start with *MATH 2313 Calculus I*
- If test scores are low in Math then may need to start with other courses
- *Univ Advisor and Faculty Advisor will discuss*

# Other High School Courses

- Optional but good
  - Drafting/CAD
  - Participation in technical competitions
    - Future City
    - Robotics
- Programming
  - If you took C/Java/C++/VB.... programming in high school probably ready for required course *ENGR 1213 Engineering Computing*.
  - If no programming experience should take *CMSC 1513 Beginning Programming*

# EP - Advisement

- Advisement is required for all EP majors each semester.
- Purpose is make sure students are taking correct courses to ensure achievement of the each student's academic goals.
- Each student is assigned a faculty advisor in their area.
- Faculty can also help with career and graduate school advice.

# EP Curriculum - general

- Physics (4-8 courses):
  - Mechanics, Waves, Thermodynamics, Electricity, Magnetism, Circuits, Modern Physics, Optics, Solid State Physics, Photonics, Laser Physics. Quantum Mechanics.
- Engineering Science (6-8 courses):
  - Rigid Body Mechanics, Electrical Science, Strength of Materials, Fluid Mechanics, Signals and Systems, Analog/Digital Electronics.
- Math (5 – 7 courses):
  - Calculus, Differential Equations, Mathematical Physics or Engr., Matrix Algebra

# EP Curriculum - general

- Engineering and Computers (3-5 courses):
  - Programming, Numerical Methods, Data Acquisition, Simulation
- Chem (1-3 courses):
  - Gen. Chem I & Gen. Chem II
- Engineering Specialty (3-5 courses):
  - Mechanical, Electrical, Applied Physics, .....

# UCO Engineering Physics-Electrical Systems

These courses have prerequisites. To make sure you meet the prerequisites look in the Course Catalog.

Year 1		Year 2		Year 3		Year 4	
Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring
MATH 2305 Appl Calc 1/2 <b>CC/Quant</b>	MATH 2338 Calculus 3	MATH 2343 Calculus 4	MATH 3103 Diff Eqn	PHY 3883 Math Phys I	ENGR 3183 EM Fields I	ENGR 3283 Engr. Optics	ENGR 4422 Senior Design II
PHY 2014 P&E I & Lab <b>CC/Quant</b>	PHY 2114 P&E II & Lab	ENGR 2033 Statics	ENGR 3302 Engr. Exp.	ENGR 3404 Analog Elec & Lab	ENGR 3324 Sig & Cntrl Sys & Lab	ENGR 4412 Senior Design I	HIST 1483/1485 Hist of US <b>CC/Hist</b>
ENGR 1112 Intro to Engr	ENGR 1213 Engr Computing <b>CC/Life</b>	ENGR 2303 Electrical Science	PHY 3103 Mod Phys	ENGR 3203 Thermodynamics	ENGR 3443 Fluid Mechanics	ECON 1103 Intro to Econ <b>CC/Soc</b>	FMKT 2323 Global Div/Prot <b>CC/Cult</b>
ENG 1113 English Comp <b>CC/Comm</b>	PHIL 1123 Ctmp Moral Prb <b>CC/Crit</b>	ENGR 2311 Electrical Science Lab	ENGR 2143 Str of Matic	ENGR 3703 Comp Meth Engr	HUM 2113/2223 Humanities <b>CC/Crit</b>	ENGR 4333 Dig Image Proc	BIO 1114 Gen Bio <b>CC/Quant</b>
COMM 1113 Fund of Speech <b>CC/Comm</b>	ENG 1213 English Comp Rec <b>CC/Comm</b>	CHEM 1103 Gen Chem I	ENGR 2043 Dynamics	POL 1113 Am Nat Govt <b>CC/Hist</b>	ENGR 3604 Dig Elec & Lab	ENGR 4613/4633 Photonics/Solid State Devices	ENGR 4323 Digital & Analog Comm
		CHEM 1112 Gen Chem I Lab	HLTH 1112 Hlth Life Skills <b>CC/Life</b>				
<div style="border: 1px solid black; padding: 5px; margin: 10px auto; width: 80%;"> <p style="text-align: center; margin: 0;"><b>Core Curriculum</b></p> <p><b>CC/Comm</b> Written and Oral Communication</p> <p><b>CC/Crit</b> Critical Inquiry Aesthetic Analysis</p> <p><b>CC/Cult</b> Cultural and Language Analysis</p> <p><b>CC/Hist</b> Historical and Political Analysis</p> <p><b>CC/Life</b> Life Skills</p> <p><b>CC/Quant</b> Quantitative Reasoning/Sci. Method</p> <p><b>CC/Soc</b> Social and Behavioral Analysis</p> </div>							
<b>17 hrs.</b>	<b>16 hrs.</b>	<b>15 hrs.</b>	<b>16 hrs.</b>	<b>16 hrs.</b>	<b>17 hrs.</b>	<b>14 hrs.</b>	<b>15 hrs.</b>

The UCO Engineering Physics Program is accredited by the Engineering Accreditation Commission of ABET, 111 Market Place, Suite 1050, Baltimore, MD, 21202-4012 – telephone: (410) 347-7700.

# UCO Engineering Physics-Mechanical Systems

These courses have prerequisites. To make sure you meet the prerequisites look in the Course Catalog.

Year 1		Year 2		Year 3		Year 4	
Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring
MATH 2305 Appl Calc 1/2 <span style="background-color: #0056b3; color: white; font-size: 8px;">CC/Quant</span>	MATH 2333 Calculus 3	MATH 2343 Calculus 4	MATH 3103 Diff Eqn	PHY 3883 Math Phys I	ENGR 3183 EM Fields I	ENGR 3283 Engr. Optics	ENGR 4422 Senior Design II
PHY 2014 P&E I & Lab <span style="background-color: #0056b3; color: white; font-size: 8px;">CC/Quant</span>	PHY 2114 P&E II & Lab	ENGR 2033 Statics	ENGR 3302 Engr. Exp.	ENGR 3404 Analog Elec & Lab	ENGR 3324 Sig & Cntrl Sys & Lab	ENGR 4412 Senior Design I	HIST 1483/1493 Hist of US <span style="background-color: #0056b3; color: white; font-size: 8px;">CC/Hist</span>
ENGR 1112 Intro to Engr	ENGR 1213 Engr Computing <span style="background-color: #0056b3; color: white; font-size: 8px;">CC/Life</span>	ENGR 2303 Electrical Solence	PHY 3103 Mod Phys	ENGR 3203 Thermodynamics	ENGR 3443 Fluid Mechanics	ECON 1103 Intro to Econ <span style="background-color: #0056b3; color: white; font-size: 8px;">CC/Boc</span>	FMKT 2323 Global DiviProt <span style="background-color: #0056b3; color: white; font-size: 8px;">CC/Cult</span>
ENG 1113 English Comp <span style="background-color: #0056b3; color: white; font-size: 8px;">CC/Comm</span>	PHIL 1123 Ctmp Moral Prb <span style="background-color: #0056b3; color: white; font-size: 8px;">CC/Crit</span>	ENGR 2311 Electrical Solence Lab	ENGR 2143 Str of Matic	ENGR 3703 Comp Meth Engr	HUM 2113/2223 Humanities <span style="background-color: #0056b3; color: white; font-size: 8px;">CC/Crit</span>	ENGR 4123 Adv Heat Trans	BIO 1114 Gen Bio <span style="background-color: #0056b3; color: white; font-size: 8px;">CC/Quant</span>
COMM 1113 Fund of Speech <span style="background-color: #0056b3; color: white; font-size: 8px;">CC/Comm</span>	ENG 1213 English Comp Rec <span style="background-color: #0056b3; color: white; font-size: 8px;">CC/Comm</span>	CHEM 1103 Gen Chem I	ENGR 2043 Dynamics	POL 1113 Am Nat Govt <span style="background-color: #0056b3; color: white; font-size: 8px;">CC/Hist</span>	ENGR 3503 Mech Engr Lab	ENGR/PHY xxx3 Elective	ENGR 4533 Therm Sys Des <span style="background-color: #0056b3; color: white; font-size: 8px;">CC/Quant</span>
		CHEM 1112 Gen Chem I Lab	HLTH 1112 Hlth Life Skills <span style="background-color: #0056b3; color: white; font-size: 8px;">CC/Life</span>				
<b>Core Curriculum</b> <span style="background-color: #0056b3; color: white; font-size: 8px;">CC/Comm</span> Written and Oral Communication <span style="background-color: #0056b3; color: white; font-size: 8px;">CC/Crit</span> Critical Inquiry Aesthetic Analysis <span style="background-color: #0056b3; color: white; font-size: 8px;">CC/Cult</span> Cultural and Language Analysis <span style="background-color: #0056b3; color: white; font-size: 8px;">CC/Hist</span> Historical and Political Analysis <span style="background-color: #0056b3; color: white; font-size: 8px;">CC/Life</span> Life Skills <span style="background-color: #0056b3; color: white; font-size: 8px;">CC/Quant</span> Quantitative Reasoning/Sci. Method <span style="background-color: #0056b3; color: white; font-size: 8px;">CC/Boc</span> Social and Behavioral Analysis							
17 hrs.	16 hrs.	15 hrs.	16 hrs.	16 hrs.	16 hrs.	14 hrs.	15 hrs.

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**ENGR/PHY xxx3 Electives**  
 Choose any 3000 or 4000 level PHY or ENGR course with the following exceptions: PHY 3014, PHY 3044, PHY 3054, or PHY 3603.

# UCO Engineering Physics-Physics

These courses have prerequisites. To make sure you meet the prerequisites look in the Course Catalog.

Year 1		Year 2		Year 3		Year 4		
Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	
MATH 2305 Appl Calc 1/2 <b>CC/Quant</b>	MATH 2333 Calculus 3	MATH 2343 Calculus 4	MATH 3103 Diff Eqn	PHY 3883 Math Phys I	ENGR 3183 EM Fields I	ENGR 3283 Engr. Optics	ENGR 4422 Senior Design II	
PHY 2014 PSE I & Lab <b>CC/Quant</b>	PHY 2114 PSE II & Lab	ENGR 2033 Statics	ENGR 3302 Engr. Exp.	ENGR 3404 Analog Elec & Lab	ENGR 3324 Sig & Cntrl Sys & Lab	ENGR 4412 Senior Design I	HIST 1483/1483 Hist of US <b>CC/Hist</b>	
ENGR 1112 Intro to Engr	ENGR 1213 Engr Computing <b>CC/Life</b>	ENGR 2303 Electrical Science	PHY 3103 Mod Phys	ENGR 3203 Thermodynamics	ENGR 3443 Fluid Mechanics	ECON 1103 Intro to Econ <b>CC/Econ</b>	FMKT 2323 Global Div/Prot <b>CC/Cult</b>	
ENG 1113 English Comp <b>CC/Comm</b>	PHIL 1123 Cmp Moral Prb <b>CC/Crit</b>	ENGR 2311 Electrical Science Lab	ENGR 2143 Str of Matic	ENGR 3703 Comp Meth Engr	HUM 2113/2223 Humanities <b>CC/Crit</b>	ENGR 4833 Solid State Dev	BIO 1114 Gen Bio <b>CC/Quant</b>	
COMM 1113 Fund of Speech <b>CC/Comm</b>	ENG 1213 English Comp Res <b>CC/Comm</b>	CHEM 1103 Gen Chem I	ENGR 2043 Dynamics	POL 1113 Am Nat Govt <b>CC/Hist</b>	PHY 4003 Math Phys II	PHY 4183/ ENGR 4183 Analytical Mech./ EM Fields II	PHY 4173/4203 Class/Quant Mech	
		CHEM 1112 Gen Chem I Lab	HLTH 1112 Hlth Life Skills <b>CC/Life</b>		ENGR/PHY xxx3 Elective			
<b>Core Curriculum</b> <b>CC/Comm</b> Written and Oral Communication <b>CC/Crit</b> Critical Inquiry Aesthetic Analysis <b>CC/Cult</b> Cultural and Language Analysis <b>CC/Hist</b> Historical and Political Analysis <b>CC/Life</b> Life Skills <b>CC/Quant</b> Quantitative Reasoning/Sci. Method <b>CC/Sec</b> Social and Behavioral Analysis		<p>The UCO Engineering Physics Program is accredited by the Engineering Accreditation Commission of ABET, 111 Market Place, Suite 1050, Baltimore, MD, 21202-4012 – telephone: (410) 347-7700.</p>						<b>ENGR/PHY xxx3 Electives</b> Choose any 3000 or 4000 level PHY or ENGR course with the following exceptions: PHY 3014, PHY 3044, PHY 3054, or PHY 3503.
17 hrs.	16 hrs.	15 hrs.	16 hrs.	16 hrs.	19 hrs.	14 hrs.	15 hrs.	

# Employment

- Local/Regional
  - Aerospace Industry
    - Boeing, Northrup Grumman, Tinker, FAA
  - Energy Industry
    - OGE, Chesapeake, Devon, Alchem
  - Telecommunications
  - Start-ups: Gridlogix (control systems)
- National
  - DOE Labs, NSWC

# Grad. School – Engineering and Physics

- OU
  - Elec. Engr, Mech. Engr, Biomedical Engr, Aerospace Engr., Physics, Applied Math, Engr. Phys.
- OSU
  - Physics, Elec. Engr, Mech. Engr
- Vanderbilt
  - Nano Materials Engr.
- Kent State
  - Liquid Crystal Institute
- Others:
  - U of Ark., UT-Dallas, U of Colo.

# Money

- Employment
  - Wide Variation
  - in OKC area with no experience (last 6 years)
    - \$50K - \$65K
  - With MS in EP
    - \$60K - \$75K
- Engineering and Physics Grad. School
  - **YOU DO NOT USUALLY PAY TUITION**
  - Stipends – wide variation: \$15K - \$37K.
  - Research and Teaching Assistantships

# Engineering Physics Research Areas

- Laser Tweezers – Optics/Optoelectronics (Jassemnejad)
- Photothermal Laser Cancer Treatment (Chen)
- Cochlear implants and related hearing research (Bingabr)
- Non-linear dynamics / Relativity and Quantum Mechanics (Wilson)
- Microfluidics (Lemley)
- Digital Imaging (Jiang)
- Rotating Fluids (Martin)
- Bio-Fluid Flows / Hemodynamics (Seong)
- Liquid Crystals / Optics (Abu-Abed)
- MEMS / Material Fracture & Failure (Khandaker)

# Conclusions

- EP is rigorous engineering degree.
- Prep. for many careers (lots of options)
- Employment in various engineering fields
- Grad. school in trad. engr. disciplines and in physics and in crossover interdisciplinary fields.
- Salaries and job security are good.
- Hard work goes a long way.

# Questions

- Evan Lemley, Ph.D.
  - 221D Howell Hall
  - [elemley@uco.edu](mailto:elemley@uco.edu)
  - <http://evan.lemley.org>
- Advisement (required for all Engineering majors at UCO)
  - Starts in October (Dr. Baha will announce)