

# Bachelor of Science in Physics Degree Learning Goals Map

(Revised 3/25/09)

## Physics Learning goals (revised 6/06):

1) Students can design procedures for controlled experiments, interpret data graphically and statistically, and perform error analysis, including error propagation and identification of systematic and random errors. Students can skillfully operate standard laboratory equipment such as oscilloscopes, function generators, multimeters, power supplies, frequency counters, spectrometers, and measuring instruments with vernier scales. They understand the limitations of the instruments and equipment.

2) Students can gather information from a variety of sources and combine in a thoughtful way, along with background knowledge, into a coherent presentation. Students have proper degree of skepticism and awareness of the possibility of errors in sources and are sensitive to contradictions and ambiguities. Students ask questions that a trained physicist would naturally ask in a given situation and seek clarification until a satisfying conclusion is reached.

3) Students achieve a working knowledge of the major fields of physics – Newtonian mechanics, classical electricity and magnetism, waves, thermodynamics, special relativity, and quantum mechanics. They understand the consequences of the basic conservation laws of energy, momentum, angular momentum, and electric charge. They are capable of solving problems that require combining concepts from multiple fields.

4) Students achieve a level of mathematical competency that enables them to solve a wide variety of problems in physics. These include multivariate and vector calculus, ordinary and partial differential equations, vectors and tensors, matrix algebra, and functions of a complex variable.

## Physics Core:

Required Course	Cr. Hrs	Learning goals
<b>Phys 230</b>	<b>4</b>	<b>3,4</b>
<b>Phys 231</b>	<b>4</b>	<b>1,3,4</b>
<b>Phys 232</b>	<b>1</b>	<b>3,4</b>
<b>Phys 233</b>	<b>1</b>	<b>1,3,4</b>
<b>Phys 234</b>	<b>4</b>	<b>1,2,3,4</b>

<b>Phys 330</b>	<b>3</b>	<b>3,4</b>
<b>Phys 400</b>	<b>1</b>	<b>2</b>
<b>Phys 425</b>	<b>3</b>	<b>3,4</b>
<b>Phys 431</b>	<b>3</b>	<b>3,4</b>
<b>Math 122</b>	<b>4</b>	<b>4</b>
<b>Math 123</b>	<b>4</b>	<b>4</b>
<b>Math 223</b>	<b>4</b>	<b>4</b>
<b>Math 224</b>	<b>3</b>	<b>4</b>
<b>CSIT 106 or 121</b>	<b>3</b>	<b>4</b>

**Track I – Theoretical emphasis:**

<b>Required Course</b>	<b>Cr. Hrs</b>	<b>Learning Goals</b>
<b>Phys 331</b>	<b>3</b>	<b>3,4</b>
<b>Phys 333</b>	<b>3</b>	<b>3,4</b>
<b>Phys 426</b>	<b>3</b>	<b>3,4</b>
<b>Phys. elective</b>	<b>3</b>	<b>varied</b>
<b>Phys elective</b>	<b>3</b>	<b>varied</b>

Note: electives to consist of 6 or more credits from PHYS 321-479,490.

**Track II – Experimental emphasis:**

<b>Required Course</b>	<b>Cr. Hrs</b>	<b>Learning Goals</b>
<b>Phys 333</b>	<b>3</b>	<b>3,4</b>
<b>Phys 340</b>	<b>3</b>	<b>2,3,4</b>
<b>Phys 341</b>	<b>1</b>	<b>1,2</b>
<b>Phys. 426</b>	<b>3</b>	<b>3,4</b>
<b>Phys 450 or Expt. project</b>	<b>1</b>	<b>1,2</b>
<b>Phys elective(s)</b>	<b>4</b>	<b>varied</b>

Note: electives to consist of 4 or more credits from PHYS 321-479,490.

**Track III – Computational emphasis:**

<b>Required Course</b>	<b>Cr. Hrs</b>	<b>Learning Goals</b>
<b>Phys 331</b>	<b>3</b>	<b>3,4</b>
<b>Phys 333</b>	<b>3</b>	<b>3,4</b>
<b>Phys 426</b>	<b>3</b>	<b>3,4</b>
<b>Comp. Phys. project</b>	<b>1</b>	<b>2,4</b>
<b>Phys elective(s)</b>	<b>4</b>	<b>varied</b>

<b>Math 231</b>	<b>4</b>	<b>4</b>
<b>Math 325</b>	<b>3</b>	<b>4</b>
<b>Csit 221</b>	<b>3</b>	<b>4</b>

Note: electives to consist of 4 or more credits from PHYS 321-479,490.

#### **Track IV – Physics with Cooperative Engineering:**

<b>Required Course</b>	<b>Cr. Hrs</b>	<b>Learning Goals</b>
<b>Phys 321</b>	<b>4</b>	<b>3</b>
<b>Phys 426</b>	<b>3</b>	<b>3,4</b>
<b>Phys 331 or 333</b>	<b>3</b>	<b>3,4</b>
<b>Phys. 323 or 325/326 or 326/328</b>	<b>3-4</b>	<b>1,3,4</b>

Plus 12 additional hours of Science, Mathematics, computer science, engineering or education (includes additional physics courses – one must be from PHYS 322-328 or 340/341):

<b>Elective Course</b>	<b>Cr. Hrs</b>	<b>Learning Goals</b>
<b>PHYS 322-328, 340/341</b>	<b>3-4</b>	<b>varied</b>
	<b>3</b>	
	<b>3</b>	
	<b>3</b>	

#### **Track V– Physics with Prelaw:**

<b>Required Course</b>	<b>Cr. Hrs</b>	<b>Learning Goals</b>
<b>Phys 340</b>	<b>3</b>	<b>2,3,4</b>
<b>Phys 341</b>	<b>1</b>	<b>1,2</b>
<b>Phys elective</b>	<b>3</b>	<b>varied</b>
<b>Phys. elective</b>	<b>3</b>	<b>varied</b>
<b>Phys elective</b>	<b>3</b>	<b>varied</b>
<b>Stat 250 or 350</b>	<b>3</b>	<b>4</b>
<b>Poli 276</b>	<b>3</b>	
<b>Poli 277 or Buad 310</b>	<b>3</b>	
<b>Phil 106 or 116</b>	<b>3</b>	
<b>Phil 218 or Phil 310</b>	<b>3</b>	

Note: electives to consist of 9 or more credits from PHYS 321-479,490.

**Track VI – Physics with Premed/Biophysics:**

<b>Required Course</b>	<b>Cr. Hrs</b>	<b>Learning goals</b>
<b>Phys 340or Phys 325</b>	<b>3</b>	<b>3,4</b>
<b>Phys 341 or Phys 327</b>	<b>1</b>	<b>1,2</b>
<b>Chem 115</b>	<b>3</b>	
<b>Chem 116</b>	<b>3</b>	
<b>Chem 125</b>	<b>1</b>	
<b>Chem 126</b>	<b>1</b>	
<b>Chem 215</b>	<b>3</b>	
<b>Chem 216</b>	<b>3</b>	
<b>Chem 225</b>	<b>1</b>	
<b>Chem 226</b>	<b>1</b>	
<b>Biol 131</b>	<b>3</b>	
<b>Biol 132</b>	<b>1</b>	
<b>Biol 133</b>	<b>3</b>	
<b>Biol 134</b>	<b>1</b>	
<b>Biol 237</b>	<b>3</b>	
<b>Biol 238</b>	<b>1</b>	
<b>Biol 336</b>	<b>3</b>	
<b>Biol 337</b>	<b>1</b>	

**Elective course learning goals not given above**

<b>Required Course</b>	<b>Cr. Hrs</b>	<b>Learning Goals</b>
<b>Phys 322</b>	<b>3</b>	<b>3</b>
<b>Phys 324</b>	<b>3</b>	<b>3,4</b>
<b>Phys 325</b>	<b>3</b>	<b>3,4</b>
<b>Phys 327</b>	<b>3</b>	<b>1,2</b>
<b>Phys 434</b>	<b>3</b>	<b>3,4</b>
<b>Phys 440</b>	<b>1</b>	<b>2,3,4</b>