With new required Cognates, effective Fall 2019.

WESTERN MICHIGAN UNIVERSITY
Suggested Sequence of Courses for the
Physics Major, College of Arts and Sciences
Subject to requirements of WMU Liberal Education Curriculum

First Semester (Fall)		**credit hours**	**Pre-requisites, etc.**
PHYS 1905	The Universe of Physics	1	none
MATH 1700*	Calculus I, Sci. & Eng. Applic.	4	MATH 1180 or placement into Calc. I
CHEM 1100/1110	General Chemistry I	4	MATH 1110
General Education/additional minor electives		6-7	
Second Semester (Spring)			
MATH 1710*	Calculus II, Sci. & Eng. Applic.	4	MATH 1700 or 1220
PHYS 2050	University Physics I	4	MATH 1710 or 1230 **or concurrent**
PHYS 2060	University Physics I Lab.	1	
Gen.Ed./required cognate elective/add. minor elect.		6-7	
Third Semester (Fall)			
MATH 2720	Multivariate Calculus & Matrix Algebra	4	MATH 1710 or 1230
PHYS 2070	University Physics II	4	PHYS 2050 **and** MATH 1710 or 1230
PHYS 2080	University Physics II Lab.	1	PHYS 2050
Computer Science Prog./Gen. Ed/minor electives		6-7	
Fourth Semester (Spring)			
MATH 3740	Intro. to Differential Eqns. & Linear Algebra	4	MATH 2720
PHYS 3090	Intro. Modern Physics	4	PHYS 2070 **and** MATH 2720
PHYS 3100	Intro. Modern Physics Lab.	1	PHYS 2060 **and** 2080
Computer Science Prog./Gen. Ed/add. minor electives		6-7	
Fifth Semester (Fall)			
MATH 5720	Vector Calculus & Complex Variables	4	MATH 3740
PHYS 2500	Waves & Optics	3	PHYS 2070
PHYS 3300	Thermodynamics	3	PHYS 3090
Gen.Ed./required cognate elective/add. minor elect.		5-6	
Sixth Semester (Spring)			
PHYS 4200	Analytical Mechanics	4	PHYS 2070 **and** MATH 3740
PHYS 3420	Electronics	4	PHYS 3090 or concurrent
PHYS 3250**	Intro to Astrophysics (optional)	3	PHYS 3090
Gen.Ed./required cognate elective/add. minor elect.		4-8	

(Continued on back)

		credit hours	Pre-requisites, etc
Seventh Semester (Fall)			
PHYS 4400	Electromagnetism	4	PHYS 3090 **and** MATH 5720 **or concurrent**
PHYS 4600	Quantum Mechanics	3	PHYS 3090 **and** MATH 3740
Gen.Ed./required cognate elective/add. minor elect.		8-9	
Eighth Semester (Spring)			
PHYS 4660***	Advanced Laboratory	3	PHYS 3420 **and** PHYS 4600
Additional electives related to major/ Gen.Ed./required cognate elective/add. minor elect.		12-13	As needed and/or as approved by advisor.

* MATH 1220 and MATH 1230 may be substituted for MATH 1700 and MATH 1710, respectively.
** PHYS 3250 satisfies the Cognate requirement (see below). PHYS 3250 is also a required course in the Astronomy minor program, and should be taken in the Spring of their Junior year so that they can take PHYS 4980 subsequently.
*** PHYS 4660 satisfies the Baccalaureate Writing Requirement.

There is a required Cognate sequence for LEC Physics majors:
CHEM 1100 - General Chemistry I (3 CH) and CHEM 1110 (1 CH)
plus one of the following:
CHEM 1120 - General Chemistry II (3 CH) and CHEM 1130 (1 CH)
or PHYS 3250 - Introduction to Astrophysics (3 CH; pre-req. PHYS 3090)
or STAT 3640 - Foundations of Data Analysis (4 CH; pre-req. MATH 1230 or 1710)
or a course (3 CH or greater) at the 2000-level or higher approved by the advisor.

The Department requires LEC Physics majors to be proficient in a computer programming language before graduation. This requirement may be met by demonstrating proficiency or by passing a computer programming course *approved by the advisor*, with a grade of C or higher. Additional programming experience is encouraged. Students should meet with the advisor.

Other notes:

- The above set of required MATH courses constitutes the required minor in Mathematics.
- With the exception of PHYS 3090/3100, 3000-level and above physics courses are offered only once per year. For added flexibility, PHYS 2050/2060 is generally offered in the Summer I session, and PHYS 2070/2080 is generally offered in the Summer II session. PHYS 4980 (Special Problems) and 5980 (Selected Topics) are available during any term, including Summer I & II, with the consent of the instructor and the department chair. MATH 5720 is also sometimes offered in Summer.
- Students are strongly encouraged to become involved in research and other experiences outside of course work, especially those who are considering graduate work in physics. Work within a research program can be accompanied by course credit (e.g., PHYS 4980).

- **Additional courses of interest to the Physics major are:**
  - PHYS 3250 Introduction to Astrophysics (3 cr.hrs., pre-req: PHYS 3090; Spring only)
  - STAT 3640 Foundations of Data Analysis (4 cr.hrs.; pre-req: MATH 1230 or 1710; Fall / Spring)
  - Additional courses in computer programming
  - MATH 5740 Advanced Differential Equations (3 cr.hrs., pre-req: MATH 3740; Spring and sometimes Summer)
  - MATH 5070 Numerical Methods (3 cr.hrs., pre-req: Math 3740, some programming experience; Fall and sometimes Summer.)
  - PHIL 3550 Philosophy of Science (3 cr.hrs.) or PHIL 3710 or PHIL 3720 History and Philosophy of Science I, II (each 3 cr.hrs.)
  - A course in writing in the sciences (e.g., ENGL 4080)

Refer to the undergraduate course catalog for final authority regarding graduation requirements.