

**Editor's Note:** The syllabus that follows complements “Ancient Chinese Science and the Teaching of Physics” by Matthew Marone from the *EAA* spring 2016 issue (vol. 21, no. 1, p. 20-26). If you have any questions about the readings and course materials listed in the syllabus, you may contact Matthew Marone at [marone\\_mj@mercuer.edu](mailto:marone_mj@mercuer.edu).

## **PHY 108 Ancient Chinese Science and Technology** **中国古代科学技术 Zhōng Guó Gǔ Dài Kē Xué Jī Shù**

*“It is well to observe the force and virtue and consequence of discoveries. These are to be seen nowhere more clearly than those three which were unknown to the ancient, and of which the origin, though recent, is obscure and inglorious; namely printing, gunpowder, and the magnet. For these three have changed the whole face and stage of things throughout the world...”- Francis Bacon*

**Text:** *The Genius of China*, Robert Temple. I will provide some copies from additional outside sources.

**Instructor:** Dr. Matt Marone Room 243 Science and Engineering Building

Chinese form of address you may wish to use:

I use Mǎ as my surname in Chinese-马教授 Mǎ jiàoshòu (Professor), 马博士 Mǎ bó shì (Doctor)

Phone 301-2597, e-mail: [marone\\_mj@mercer.edu](mailto:marone_mj@mercer.edu)

**Assistance outside of class:** MW 2-3:30, SEB243 outside of these hours please make an appointment. You may email me your questions.

**Lecture:** MWF 11-11:50, Room SEB 144

**Lab:** T 9:25-12:05 Room SEB 215. You will also be required to attend several night labs when we cover the Astronomy portion of the course. The location and times will be announced.

### **General:**

Francis Bacon thought that printing, gunpowder and the magnetic compass were inventions that changed the world. He did not realize that they all shared a common origin in ancient China. Few people in the Western world know of the great scientific achievements that occurred in ancient China; many of which predated European science and the Renaissance. We shall explore these discoveries in their historical Chinese context and through the lens of our current scientific understanding. The Chinese discoveries and inventions, we will study will be presented with their tradition and often metaphysical explanations. We will then attempt to understand the scientific principles behind them. This will not just be a theoretical course but there will also be a strong “hands on” component. We will attempt to re-create several different Chinese inventions or technologies used by the Chinese in ancient times. Our laboratory experiments will allow students to analyze ancient technology using modern methods and tools. Although this is not a language class, students will be expected to recognize Chinese names and terminology. These terms will be transliterated into the Pin Yin commonly used in the PRC. There is no math prerequisite, but knowledge of high school algebra is required.

This class fulfills requirements in the Natural World Block of Mercer's General Education program. We will pursue our study of physics guided by the overarching principles of the Natural World Block which are as follows:

1. Generate a hypothesis to explain natural phenomena
2. Collect and organize experimental data in a format appropriate to a scientific field;
3. Analyze data through the use of quantitative and/or qualitative scientific reasoning;
4. Interpret a hypothesis in light of experimental evidence;
5. Accurately communicate scientific knowledge, observations, analyses, and/or conclusions.

Some of these principles will be addressed in lecture and some fit more naturally in the laboratory portion of this class.

**Grades:**

A (90 and above), B+ (85-89), B (80-84), C+ (75-79), C (70-74), D (60-69) F (below 60)  
Your Final class grade will be derived from the following percentages

Tests (45%)

In-class Quiz (10%)

Final Exam (20%)

Labs (25%)

You will **not** be graded on a “**curve**”.

Extra Credit will only be available on in class exams, **if** available at all.

**Reflective Writing Assignment:**

This class is unique in the history of Mercer and Sinology. I would like you to record your impressions, expectations and thoughts about the class. This will occur three times during the semester. The assignment will be anonymous but each student is required to participate. I will not grade the assignment, but you must complete it or receive a grade of incomplete for the class.

**Electronic Submission of Assignments:**

Students bear sole responsibility for ensuring that papers or assignments submitted electronically to a professor are received in a timely manner and in the electronic format(s) specified by the professor. Students are therefore obliged to have their e-mail client issue a receipt verifying that the document has been received. Students are also strongly advised to retain a copy of the dated submission on a separate disk. Faculty members are encouraged, but not required, to acknowledge receipt of the assignment

**Tests:** Make-up exams will only be given to students with valid excuses as defined by the university handbook (illness, emergency, class trips with prior notification). The make-up exam may be harder or easier than the regular in-class exam. Any disputes concerning a test grade must be resolved within one week from the time the tests are returned or from the time the grades are made known to the class. Partial credit will be awarded depending how many steps were done correctly in a multi-step problem. The amount of

credit will be at the discretion of the instructor. **No equation sheets are permitted.** A list of useful equations and constants will be provided with the test. If you are late to class and arrive while the test is in progress you will have only the remaining time to complete your quiz. If you come in after the test, you will not have the opportunity to make it up. Do not be late!

**Quizzes:** There will be a 5-10 minute quiz every week. This quiz will cover any material discussed in class up to that point of time. Make-up quizzes are subject to the same conditions as make-up tests. The Quiz will usually be on Friday. It may be necessary to change the day and the change will be announced. No quiz last week of classes. . If you are late to class and arrive while the quiz is in progress you will have only the remaining time to complete your quiz. If you come in after the quiz, you will not have the opportunity to make it up. Do not be late!

**Final Exam:** The final exam may include **any** material discussed in class. Make-up exams will be subject to the same conditions as make-up tests.

**Laboratory reports:** You will write a lab report for each experiment. Some experiments will take several weeks to complete. The report will be due one week after the last laboratory session related to that experiment. The format for the reports varies. I will give you instructions concerning the format in lab class. Reports will be graded on a scale of 0-4, with 4 being a very good report. You may write group lab reports or individual reports. For a group report, all members of the group will receive the same grade. I will explain the detail of how to write a lab report in lab class.

**Media Release:** Owing to the unique nature of this class there will be times that I will photograph or make video recordings of students conducting experiments. I may use these images in presentations, websites, books and other media. You will be provided with a media release form that you must sign. If you do not wish your image to be used in anyway you must inform me. You may give you consent for me to use your image anonymously or with your name in a caption. In so doing you grant me the use of your image free of charge with no expectation of payment, royalty, or influence upon your grade. If you are a minor, please inform me and I will avoid using your image.

**Illness:** If you are ill and will miss class please contact me. We can make arrangements to make up the missed work and I can inform you what material you need to read. If you are ill, please do not come to class. Students are advised to call or email the Student Health Center ( 301-2696 or shcmacon@mercer.edu) to report influenza-like symptoms. Students judged to have influenza-like symptoms will be instructed that they should not attend class, avoid contact with others as much as possible, and return to their normal schedule after they are free of fever (100°F or 37.8°C), or signs of a fever without the use of fever-reducing medications.

**Honor code:** You are bound by the Mercer honor code. The College's academic misconduct policy will be followed. All work, for which a grade is received, must be the

**original** work of the **student** without aid or assistance of another party, or any printed and or electronic data/information. I take cheating and plagiarism very seriously. Academic misconduct cases will be referred to the honor council and the student will automatically receive a grade of incomplete (IC) pending a ruling by the honor council.

**Cell Phone and Pager Usage:** Out of courtesy for all those participating in the learning experience, all cell phones and pagers must be turned off before entering any classroom, lab, or formal academic or performance event

**Classroom etiquette:** You are expected to conduct yourself as a mature student, respectful of your classmates and instructor. You may be asked to leave the room if your behavior is disturbing the instructor or your fellow students.

**Documented Disability Statement:** Students requiring accommodations for a disability should inform the instructor at the close of the first class meeting or as soon as possible. The instructor will refer you to the ACCESS and Accommodation Office to document your disability, determine eligibility for accommodations under the ADA/Section 504 and to request a Faculty Accommodation Form. Disability accommodations or status will not be indicated on academic transcripts. In order to receive accommodations in a class, students with sensory, learning, psychological, physical or medical disabilities must provide their instructor with a Faculty Accommodation Form to sign. Students must return the signed form to the ACCESS Coordinator. A new form must be requested each semester. Students with a history of a disability, perceived as having a disability or with a current disability who do not wish to use academic accommodations are also strongly encouraged to register with the ACCESS and Accommodation Office and request a Faculty Accommodation Form each semester. For further information, please contact Carole Burrowbridge, Director and ADA/504 Coordinator, at 301-2778 or visit the ACCESS and Accommodation Office website at <http://www.mercer.edu/disabilityservices>

**Evaluation forms:** In an ongoing effort to improve the quality of instruction, each student enrolled in this course is required to complete an end-of-semester course evaluation.

## **Tentative List of Chapters to be covered**

### **1) Introduction to Chinese pronunciation and characters** (not in our text)

Introduction to Joseph Needham and the work of the Needham Research Institute at Cambridge University (external references)

Chinese historical time line and important geographical locations (external references)

### **2) Forces and Motion** (our text and readings from Mo Zi 墨子)

Sliding calipers (p.97), Bells (p.220), Cartography (p.30)- Measurement

Laws of Motion (p.175) and 墨子

Steelyard Balance (墨子), Wheelbarrow (p.95)- Torque

Deep drilling for Natural gas (P.56)- Potential and Kinetic Energy

Petroleum and Natural gas as fuel(p.89)

\*\*\*\*\*Test 1 September 18 \*\*\*\*\*

### **3) Magnetism** (pp.162-171)

The first Compass

Magnetic Declination and the Earth's Magnetic Field

Magnetic Remanence and induction

### **4) Astronomy** (pp.28-41)

Sunspots and solar phenomena

Discovery of the solar wind

Equatorial Astronomical Instruments

Lunar Lodges and Constellations (external references)

\*\*\*\*\*Test 2 October 12 \*\*\*\*\*

### **5) Waves** (pp.220-239)

Properties of sound (external references)

Spouting bowls and Standing waves

Stringed Instruments

Tuned drums and bells

Timbre

Equal temperament

### **6) Optics** (from Mo Zi 墨子 and external references)

Mirrors

Magic Lantern (p.98)

Magic Mirrors (p.74)

\*\*\*\*\*Test 3 November 13 \*\*\*\*\*

### **7) Engineering, Domestic and Industrial technology**

Lacquer- the first plastic (p.84) and 3D printing

Porcelain (p.103)

Umbrella (p.108)

Matches (p.110)

Printing (p.123)

Cast Iron and Bronze (p.44)

Periodic Table and the properties of metals

Section 7 will be tested on the final exam, which is cumulative.

**Laboratory**

We will conduct laboratory experiments on the following topics:

Paper

Steelyard Balance

Silk

Magnetism

Astronomy -Will require three observing sessions (Thursday nights at 7:30p.m.-10:00p.m.)

Standing waves

Bronze

These labs will take several weeks depending on how we will proceed. Long pants closed toe shoes and safety glasses (provided) are required for all labs. I recommend wearing old clothing that can be stained. Some experiments will be very dirty. Astronomy labs will require suitable clothing for cold weather and the possibility of insects.

**Important Dates:**

August 21 Last Day for Late Registration, Drop/Add

September 7 Holiday - Labor Day

October 7 Mid Term

October 8-9 Fall Break

October 13-15 Conference

**October 23 Last Day for Course Withdrawal**

November 25-27 Thanksgiving Break

December 4 Last Class Day

\*\*\*\* Final Exam 10 December 9:00AM-12:00PM\*\*\*\*

## Media Release Form -Phy 108 Ancient Chinese Science and Technology

Owing to the unique nature of this class there will be times that I will photograph or make video recordings of students conducting experiments. I may use these images in presentations, websites, books and other media. If you do not wish your image to be used in anyway you must inform me. You may give you consent for me to use your image anonymously or with your name in a caption. In so doing you grant me the use of your image free of charge with no expectation of payment, royalty, or influence upon your grade. If you are a minor, please inform me and I will avoid using your image.

Print Student Name \_\_\_\_\_

Date \_\_\_\_\_

Age \_\_\_\_\_ Check one:  I am a minor  I am not a minor

Check any that apply:

No, thanks, please do not use any images of me

You can use images of me anonymously. That is, you can use my image but without my name

You can use my image and my name

Signature \_\_\_\_\_ Date \_\_\_\_\_

Witness:

Print Name \_\_\_\_\_ Signature \_\_\_\_\_ Date \_\_\_\_\_