

## PHYSICS 406

### Introduction to Astronomy Spring Semester 2008

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Physics Department and  
Institute for the Study of Earth, Oceans and Space  
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**Office hours:** Mo, Fr: 11:00 - 12:00 AM, Tu: 2:00 – 3:00 PM, and right after class  
or send E-Mail for an appointment, if these don't work for you

**Required Materials:** 1) **Book:** "*The Essential Cosmic Perspective*", 4<sup>th</sup> ed, Media Update  
Bennett, Donahue, Schneider, & Voith; Pearson Addison & Wesley  
with: "*Astronomy Media Workbook*" 5<sup>th</sup> ed, M. LoPresto  
& "*Lecture Tutorials for Introductory Astronomy*", 2<sup>nd</sup> ed  
Prather, Slater, Adams, Brissenden  
2) **Class Tool:** CPS-Remote Pad + Enrollment Package

**Web Site** <http://www.ssg.sr.unh.edu/406/406.html> & Blackboard

**Other Materials:** "Course Review" (distributed in class)  
"Lab Manuals" (distributed in the Lab)

*Please keep manuals in a 3-ring binder, staple Labs when handed in to your TA!*

Lecture Notes and Presentation Material posted on Blackboard

**Grading:**  $\geq 87\%$  A, A-;  $\geq 78\%$  B+, B, B-;  $\geq 69\%$  C's;  $\geq 60\%$  D's;  $< 60\%$  F  
Based on:  
**3 Exams + Final** **50%**  
Best 2 out of 3 Exams + Mandatory Final, count 1/3 each  
(multiple choice, short answer, 1-2 essay questions)  
**Lab Grade (10 Labs + Planetarium)** **25%**  
**Term Paper Grade** **10%**  
**Classroom Activities & Clicker Questions + Homework** **15%**

Missing **Final** and/or **more than 2 Lab out of 10 + Planetarium** and/or **Term Paper** leads to an **F**,  
**no matter what the % Score at that point!**

**Labs start** **Tuesday, January 29 & Wednesday, January 30**

**Bus Departure**

**Planetarium Class:** **Wednesday, February 6** **6 PM**  
(Details in Outdoor Lab Manual) **Thursday, February 7** **6 PM**

**Term Paper due:** **Monday, April 21, 2008**

#### **Exams:**

1) **Monday, February 18** Material through Wednesday, February 13  
2) **Wednesday, March 12** Material through Monday, March 10  
3) **Wednesday, April 16** Material through Friday, April 11  
**Exams #1, 2, 3 during regular class time!**

#### **Final Exam:**

**Monday, May 19, 1:00 – 3:00 PM**

All material, heavy on last quarter of class!

# 1. Grading and Course Logistics

With the exception of the Exams I want to encourage you to **work together with your classmates** on the topics of this class, during classroom activities, in the Lab, and hopefully also when studying for this class outside the classroom!!

## Graded Course Elements:

### **a) Classroom Activities/Interactive Questions/Homework:** **Full Credit: 15 %**

We will have about **classroom Activities** evenly distributed throughout the semester and **Homework assignments** (electronically through Mastering Astronomy and some in writing, such as on observations, work through questions, and a Term Paper outline). The classroom Activities may consist of:

- a Quiz with a few questions concerning the current class and/or the reading for this class
- a Group Discussion activity centered around a Class Demonstration or a difficult concept
- a One Minute paper asking you to summarize the one or two most important concept of the class and one point that you don't understand of that class

During the Activities you are encouraged to work together in a group of 2-4 students. Each student turns the work in individually. Each class may have a brief **Reading Quiz (Credit for correct)** at the beginning and a few **Interactive Questions (Attendance Bonus)**, answered with your **CPS-Remote**.

**All Activity Sheets and Homework assignments will add up to 10% of the course credit.**

You are allowed to **forgo 2 of the Activities or Homework** with no penalty. You can still get the full 10%. However, doing **all of them** earns **extra credit!** If you choose to **forgo more than 2**, you will **lose points** accordingly.

**Your responses with the CPS-Remote earn 5% of the course credit (you may miss up to 4 classes and still reach the full 5%)**

- **Class Activity sheets will be collected at the end of the class**
- **Drop any written Homework into the Physics 406 Homework Box in 3<sup>rd</sup> floor of Nesmith Hall or submit Mastering Astronomy Homework on scheduled Monday by 430 pm**

**Activities/Homework 10% + CPS Remote 5%**

### **b) Labs and Planetarium:** **Full Credit: 25 %**

You are expected to attend 10 Labs and one Planetarium Class.

If you miss a Lab or have a conflict, talk to your TA or (about the Planetarium) to me immediately!

You need **all 10 Lab activities + Planetarium for Full Credit!**

- **Missing 1 or 2 Labs** leads to the **loss of points**
- **Missing more than 2 Labs** means **failing the class**

### **c) Term Paper:** **Full Credit: 10 %**

You have to submit a Term Paper on or before the due date to earn **Full Credit!** Late points apply!

Term Paper submission is via **Safe Assignment on Blackboard** **Deadline: April 21, 11:59 PM**

You must **turn in a paper before the end of the Final Exam of this course or you Fail the class!**

**Plagiarized Papers lead to Failure of the class!**

### **d) Exams:** **Full Credit: 50 %**

**2 best out of 3 Exams during the semester count: 2/3 of Exam Credit**

**Final Exam is mandatory (no Final Exam: Fails Class): remaining 1/3 of Exam Credit**

**Your Grade will be a combination of all these items,  
which add up to 100% of the class credit.**

## 2. Getting Started for this Course

- 1) **Purchase the Course Book “*The Essential Cosmic Perspective*”, bundled with the Astronomy Media Workbook and an Access Kit for Mastering Astronomy**
- 2) **Enroll in Mastering Astronomy online**, following the instructions on the back foldout of your book. The Course ID is **PHYS406MOES2008**. Use your **full last and first name as listed on Blackboard** and use your **Blackboard login name as login name when you register** (if this doesn't work because your login is already taken, add one or two numbers at the end).
- 3) **Purchase a CPS Remote Pad** at one of the bookstores in Durham (UNH Bookstore or Durham Book Exchange). You will get a **Remote Pad** and an **Enrollment Package**.
- 4) **Sign up your clicker through Blackboard**. A detailed handout with the procedure is attached, and it can be found online. The Remote is good as long you take classes that require this interaction. The **Enrollment** is good for **one semester**, but **can be used for several classes**. You can resell the CPS Remote when not needed anymore.

## 3. Lectures and Homework

So that all students can benefit from the lecture, I ask that you observe a few simple rules. Try your best to be on time, but **if you are late, tiptoe in**. Feel free to ask questions as soon as they occur to you and NEVER laugh at anyone else's questions! **Don't talk during class** (except during Concept Quiz time). If the noise level rises I will stop and wait for the noise to subside. If you absolutely, positively must leave early, please quietly tiptoe out without disturbing your fellow students. Please **turn off cell phones, iPods, and other electronic devices**.

The purpose of the lectures is to give you a broad overview of the material, and in particular, to cover some of the more difficult points of the current subject of study. During lectures I will go over the key concepts, with emphasis on issues that you may have the most questions about and illustrate the principles with demonstrations and visuals.

Short concept **Quizzes (Concept Questions) and/or Interactive Activities** will be given in almost every lecture. *Concept questions will receive attendance bonus and be instantly graded* through e-Instruction (1/3 of the Activity/Homework Grade). *Activities (written sheets) will be marked up graded and so will your written Homework Assignments*. Together with the *Mastering Astronomy assignments* they count as 2/3 of the Activity/Homework Grade. You will be asked to discuss each Question/Activity with your neighbor, so you cannot sit alone in the lecture hall. You must enter into these discussions. The multiple choice and short answer questions on the Exams will be partly based on these concept Questions and Activities.

For the short concept Quizzes (Concept Questions) and questions on what is still the hardest part of a specific class you will have your **“Star Trek Communicator” (CPS Remote Pad)** on you. **Bring it to every class!!** It is your tool to participate in this course interactively. It helps you to learn your stuff, it tells me where there are still the greatest problems, and - last not least - it earns you a fraction of the credit needed for this class (*every time!*).

In order to participate efficiently in class you must **read the material in the book ahead of time**. I will tell you what is assigned for the coming class. **One or two simple questions in the beginning will quiz your Reading!** Reading is one part of your Homework for this class, written assignments that ask you to work through some questions, to observe the night sky and turn in a log of your observations, and to perform some intermediate steps towards your Term Paper.

## 4. The Labs

The purpose of the labs is many-fold. First, you gain hands-on experience with some astronomical principles that we discuss in lecture. Second, you begin to experience how science is done, including using a theory to design an experiment, taking measurements, and understanding sources of error. Third, in writing the Outdoor Lab reports, you will gain some experience in technical writing. Physics graduate students run the Labs. They will spend a few minutes at the beginning of lecturing on the Lab itself or on the relevant concepts.

Everyone should attend the first scheduled lab of his/her group during the *week of January 28*. The laboratories will meet in Nesmith Hall, Room 118b. You also receive Indoor and Outdoor Laboratory Manuals that describe each Lab and task ahead and walk you through each Lab.

You must hand in the Lab materials **for at least 9 of the 11 Lab activities** (*Indoor Lab Worksheets, Outdoor Lab Reports, and Planetarium Quiz*) to pass the course. All 11 are needed for 100% of the Lab Credit. *Lab reports are generally due either at the end of the Lab for the Labs that can be completed during Lab time or 2 weeks after the Lab (for example, for the Observatory or Radio Telescope write-up).* *Your Lab instructor will let you know of any change to this rule.* Labs should be placed in one the wooden boxes on the 3<sup>rd</sup> floor in Nesmith Hall that is marked with your TA's name, lab#, and lab time. *Every day your lab is late, 2 points of 20 are subtracted from your grade* Your lab Teaching Assistant will give you details on how lab reports are graded.

If you miss a lab, we strongly suggest that you try to make it up that week (contact your Lab TA). Otherwise, you can make it up during the second last week of classes, and at this time you can make up no more than two labs. (Note that this is a very busy week for many students with projects, so this is another reason to make up a missed lab as soon as possible.)

Lab TAs:	Allison Jaynes	allisonjaynes@gmail.com	2-1466
	Trevor Leonard	twp5@unh.edu	2-2067

## 5. Important Miscellaneous Policies

If you have to **miss a class for a valid reason** (such as trip for another class, team sports activity, illness, serious personal reason), **send me E-Mail beforehand** (only in case of illness afterwards, of course). CPS Remote count will be adjusted, and you are eligible for make-up of an Activity within 1 week!

**POSSESSION OF 2 OR MORE CLICKERS BY ONE STUDENT IN THE CLASSROOM** is considered a **serious offense against academic honesty and will not be tolerated**. Being caught with that offense **LEADS TO FAILING THIS CLASS** by all students who are related to the clickers in question.

**PLAGIARISM OF A TERM PAPER** (explained in detail in the Outdoor Lab Manual) is considered a **serious offense against academic honesty and will not be tolerated!** This leads automatically to an **F IN THE COURSE**.

**Cheating on an Exam** leads to **0 Points on that Exam**.

All cases concerned with Academic Honesty will be brought to the attention of the Dean of the College after notification of the offender.

**Generally there are NO Make-up Exams!** Only in very exceptional cases, such as, for example, documented sickness, an excursion for another class, or team sports events, can a make-up exam be given. Otherwise, your lowest score on the first 3 Exams is the 0 on the missed Exam.

## 6. Goals of the Course

### Understanding!! NOT Memorizing Facts!!

There will be almost no Math!

But you will have to learn a terminology and to follow some reasoning!

- 1) Logic and Methods of Astronomy: How do we know about things far away, which we cannot touch?

So I won't ask you to learn facts, but how we can get the facts.

For example:

Won't ask for the value of the Sun's temperature - may ask how we get it.

Won't ask for the Sun's mass - may ask how we get it.

How do we know that nuclear fusion occurs in the Sun?

Won't ask for Venus's distance - may ask how we get it.

How do we prove the Earth rotates?

How do we prove the Earth goes around the Sun?

Won't ask distances to stars or galaxies - may ask how we get them.

Won't ask mass of a star or galaxy - may ask how we get it.

Why are we so sure there is "dark matter" in the universe?

How do we find the diameter of a star, in spite of their distance?

What is the energy source of the stars?

How do we know our location in the Milky Way Galaxy?

How do we know that the Milky Way is rotating?

How do we know that there is gas between the stars in spiral galaxies?

How do we know that there is dust in the Milky Way?

How do we know that there are molecules in the Milky Way?

What is the importance of radio and infrared astronomy?

What is the importance of ultraviolet and X-ray astronomy?

What is the evidence that there are neutron stars?

What is the evidence that there are black holes?

Why are we convinced that the universe is expanding?

What are the pieces of evidence that the universe began in a Big Bang?

*What's new in astronomy and space science this year?*

*What are the great unsolved riddles in the universe?*

etc.

We will learn how to deal with new information and new questions, as they arise.

We will learn how to make sense of information on science pages and in science journals.

We will learn to see Science as an open-ended pursuit that will never be finished.

## Goals cont'd

We would like to

- 2) Help you appreciate what you see in the sky.
  - e.g. most people don't notice that full moon is high in winter, low in summer, even though they know that the sun is high in summer, etc.
  - e.g. why it is the best time to see Mercury after sunset in Springtime
  - e.g. when in the lunar cycle we can expect eclipses, why not every month
  - e.g. what makes a comet look like it does.
- 3) Let you know, why people do astronomy; we will touch on its history and philosophy. What its contribution has been, is and will be on our general view of the world. What the merits and the limitations of science are.
  - "Science is the most daring spiritual enterprise humankind has undertaken."*
  - Sir Hermann Bondi**, at the opening ceremony of the International Space Science Institute, Bern, Switzerland, 1995
- 4) Help you to reach a point where you can read and **understand a popular Astronomy Magazine and the Science Section in newspapers**, and to understand *the new discoveries that will be made during the next decade*. What is science and what fiction in Science Fiction?
- 5) Try to get you to appreciate the space program and to find out about the **exciting things we do in Morse Hall on Campus**.

## 7. Some Notes on "How to study"

This "Syllabus" and your copy of the "Course Review" should serve as a study guide. They pinpoint what you need to study in detail and look for in your textbook as well as listen to during the lectures, but they cannot replace studying the book or being active in the lectures!!

*The lectures will lay the foundations and build the thought bridges for the important points raised in the Review.*

*The most important underlying principles in understanding astronomy will be demonstrated with simple experiments or with computer animations in class. You will also see many beautiful pictures, brand new, as they become available!*

*The lectures will also cover supplementary issues to the book.*

*I will raise some thought questions regularly in class, and I will suggest simple observations or activities once in a while as your own homework.*

*In addition, we will have Activities in class (on average once a week). This is your opportunity to learn some important material interactively together with your classmates.*

*So don't miss classes! You will only hurt yourself!*

*Read the chapters, which are treated in class before we talk about them, and work through the Questions at the end of each chapter. We will let you know at the beginning of each lecture where we are and what the reading assignments are.*

*In the first place it should be fun to ponder these questions and to make the observations. I will not collect any homework nor take any attendance. However, you should know that some of the questions or very similar ones will show up in the Exams!!*

*So read your book, work out questions and don't miss class!!*

*New astronomical discoveries as discussed in the newspapers and in magazines will be included in the lectures as appropriate.*

*If you have comments, problems, questions, suggestions etc.,  
PLEASE, PLEASE*

- Ask questions in class (your classmates will appreciate)
  - See me after class
- Come to my office hours (that's what they are for)
  - or
  - Send me an E-Mail

# 8. Course Contents

## ***Reading Assignment via Schedule on Website***

Page Numbers in Textbook

### **0. Roots of Astronomy and Our View of the World**

**Preface, Ch 1**

- Why astronomy?
  - quest of how nature works
  - practical use of astronomy
- Science versus humanities, religion, mystics
  - ancient astronomy, old view <-> new view of the universe
  - questions, answers, methods, and limitations
- Layout of the course
  - follow historical path of astronomy (as example of science)
  - Our place in the universe: Earth, planets, sun, stars, galaxy, universe

### **I. Use of Scientific Methods**

**Ch 1**

- The awesome time scales and sizes
  - powers of ten
  - size and distance scales in our neighborhood and the universe
- To Measure Means to Compare:
- Geometry
  - angle
  - length
- Action
  - time
  - velocity
- How do we know all this from such a great distance?
  - light (radiation)
  - forces (gravity)
  - samples of material (space probes)
- Scientific reasoning and models

2-14

14-17

### **II. What we see in the sky (Earth centered Universe)**

**Ch. 2**

- Stars
  - constellations
  - celestial sphere
- Rotating sky
  - celestial pole and equator, celestial coordinates
  - horizon, visibility of stars
- Sun
  - day and night
  - seasons
  - ecliptic, zodiac
- Moon
  - phases
  - rotation
  - motion in the sky
- Eclipses
  - eclipse seasons
  - lunar and solar eclipses, uses
- Calendar
- Planets
  - motion in the sky with respect to the stars and sun

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Diagnostic techniques	
Geologic activity	
Planetary magnetic fields	
Convection & rotation of planets	
Surface of planets and moons	191-194, 196-199, 208, 212-214
Tectonic plates (Earth, Venus, Mars?)	
Volcanism in the solar system	
radioactivity (Earth, Venus, Mars)	
tides (Io, Europa)	
solar energy (Triton, comets)	
Impact craters on moon and Mercury	
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"greenhouse": none, just right or overdone	
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### Approximately Mid Semester

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Revised E. Möbius, 1/2008

# Clicker QuickTip #1

## Registering in Your First eInstruction Class

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You must register your clicker in each Blackboard course that is using eInstruction.

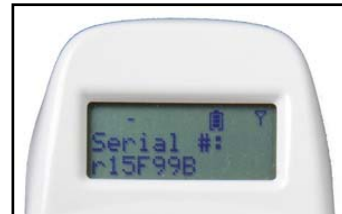
### How do I get started?

Purchase your clicker and enrollment code at the bookstore. An enrollment code is good for all of your eInstruction courses for that semester. You can also purchase a lifetime enrollment code.

### What do I need to register my clicker?

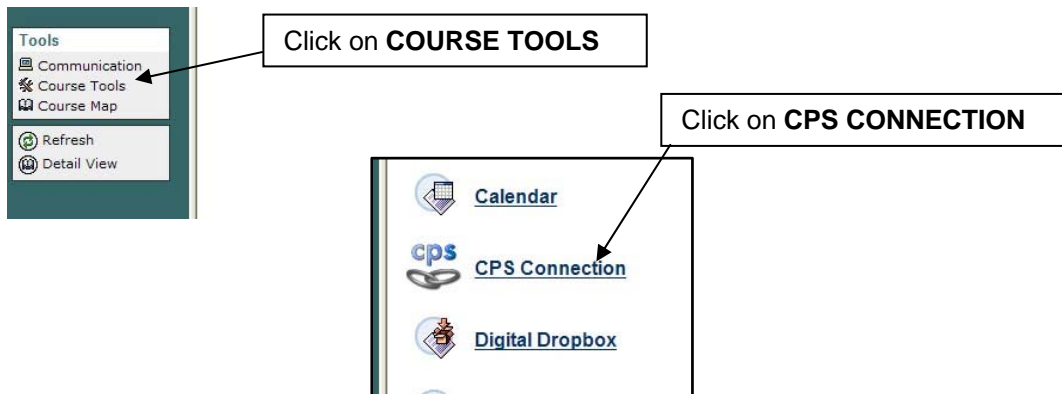
**Enrollment Code** (purchased at bookstore):

**Pad Serial #** (displays when you turn your clicker on):



### Registering your first eInstruction class

1. Go to <http://blackboard.unh.edu>
2. Sign in using your Blackboard username and password.
3. Click on the name of the course in which you want to use the clicker.
4. Click on **COURSE TOOLS**.
5. Click on **CPS CONNECTION**. The *UNH eInstruction Registration Page* appears.



6. Read the information on the page. Click **NEXT**. A new page appears.
7. Enter your *Pad serial number* and *Enrollment Code*.
  - **NOTE:** If you enter an enrollment code and receive a message that says your code is already in use try leaving the enrollment code field blank.

8. Read the *Student Refund Policy* to the right of the checkbox
9. Place a checkmark next to *I have read and agree with the Student Refund Policy*
10. Enter your elnstruction username and password in the appropriate box.
  - If you have used elnstruction before, enter your elnstruction username and password in this box. This will automatically link your information, including your payment history, to your Blackboard course. If you forgot your elnstruction username and password, contact elnstruction technical support at [www.einstruction.com/support](http://www.einstruction.com/support).
  - If you have never used elnstruction, create an elnstruction username and password.
  - Write down your username and password to refer to later.

The screenshot shows a registration form for a CPS Response Pad. It is divided into five steps:

- STEP 1:** Institution: University of New Hampshire
- STEP 2:** CPS Response Pad Serial Number: [input field] (Annotated: Enter pad serial number)
- STEP 2:** Enrollment/Coupon Code (optional): [input field] (Annotated: Enter Enrollment Code)
- STEP 3:**  I have read and agree with the [Student Refund Policy](#). (Annotated: Select "I have read...")
- STEP 4:** Two options for registration:
  - I Have Used a CPS Response Pad before:** Includes fields for Username and Password. (Annotated: Old users)
  - I Have Never Used a CPS Response Pad before:** Includes fields for Username, Password, and Confirm Password. (Annotated: New users)
- STEP 5:** Continue >> button (Annotated: Click CONTINUE)

11. Click on the **CONTINUE** button. You will see a confirmation of your action
12. Click on the **CONTINUE TO REGISTER PAD FOR THIS CLASS** button, a new page appears.
13. Click on the **REGISTER CLICKER OR UPDATE YOUR SERIAL NUMBER** button.

The screenshot shows the CPS Tool registration page. At the top left is a "CPS Tool" icon. Below it, a text box says "This tool allows you to use your Blackboard class with CPS". The date and time "Thursday, June 28, 2007 10:38:49 AM EDT" are displayed. At the bottom, there is a button labeled "Register Clicker OR Update your serial number" (Annotated: Click the REGISTER CLICKER button).

14. Read the information on the page and click **NEXT**.
15. Enter your serial number.
16. Place a Checkmark in the box to signify you agree with the *Student Refund Policy*.
17. Click on the **CONTINUE** button.

**Welcome To CPS-Blackboard Registration:**  
Thank you for purchasing a CPS Response Pad.  
To register your pad with Blackboard, enter your information in the form fields.

Institution: University of New Hampshire

**STEP 1** CPS Response Pad Serial Number:  [Help! Where is my serial number?](#)

**STEP 2** Enrollment/Coupon Code (optional):  [Enrollment Code info](#)

**STEP 3**  I have read and agree with the [Student Refund Policy](#).

**STEP 4**

Enter your pad serial number

Check the *I have read and agree with* checkbox

Click **CONTINUE**

18. You will see a confirmation that gives you your pad number for that class. Write this down. You will have a different pad number for each class.

- To register for additional classes, repeat steps 1 through 9.



## Clicker QuickTip #2 Registering Additional elnstruction Classes

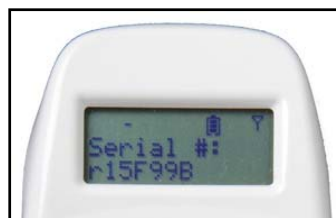
You must register your clicker in each Blackboard course that is using elnstruction.

### How do I get started?

Now that you have created an elnstruction account by registering a clicker in an elnstruction class in Blackboard, you only need your pad serial number to register your clicker in additional classes.

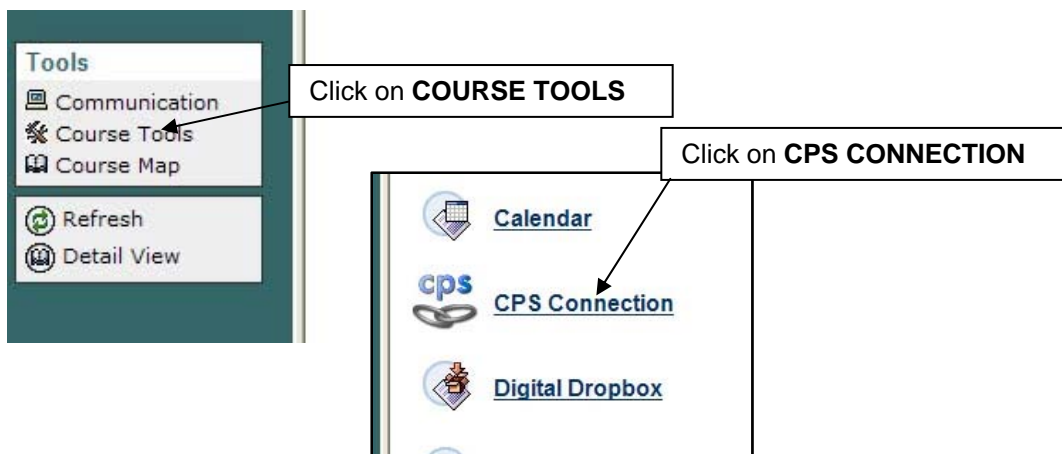
### What do I need to register my clicker in additional classes?

**Pad Serial #** (displays when you turn your clicker on):

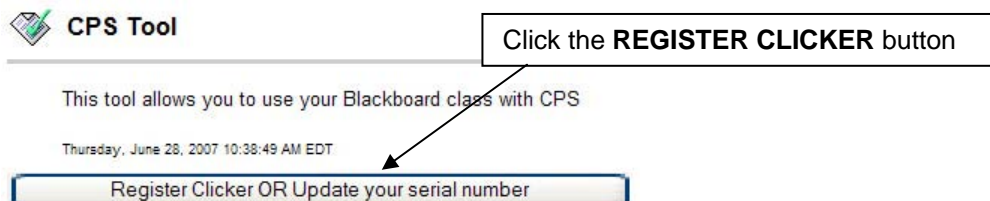


### Registering an additional elnstruction class

1. Go to <http://blackboard.unh.edu>
2. Sign in using your Blackboard username and password.
3. Click on the name of the course in which you want to use the clicker.
4. Click on **COURSE TOOLS**.
5. Click on **CPS CONNECTION**. The UNH *elnstruction Registration* page appears.



6. Click the **REGISTER CLICKER OR UPDATE YOUR SERIAL NUMBER** button.



7. Read the information on the page and click **NEXT**.
8. Enter your serial number.
9. Check off the box to signify you agree with the *Student Refund Policy*.
10. Click the **CONTINUE** button.

**Welcome To CPS-Blackboard Registration:**

Thank you for purchasing a CPS Response Pad.

To register your pad with Blackboard, enter your information in the

The screenshot shows a registration form with the following elements and annotations:

- Institution:** University of New Hampshire
- STEP 1** CPS Response Pad Serial Number:  [Help! Where is my serial number?](#)
- STEP 2** Enrollment/Coupon Code (optional):  [Enrollment Code info](#)
- STEP 3**  I have read and agree with the [Student Refund Policy](#).
- STEP 4**

Annotations with arrows pointing to specific fields:

- A box labeled "Enter your pad serial number" points to the serial number input field.
- A box labeled "Check the I have read and agree with checkbox" points to the checkbox in Step 3.
- A box labeled "Click **CONTINUE**" points to the "Continue >>" button.

11. You will see a confirmation screen which will give you your pad number for that class. Write down your pad number for this class. You will have a different pad number for each class.
  - To register for additional classes repeat steps 3 through 10.