**DEPARTMENT**: Physics  
**EFFECTIVE SESSION**: Fall 2015

**INSTRUCTIONS**: Please check the items below which describe the purpose of this request.

- [ ] 1. New course with supporting documents
- [ ] 2. Add existing course offered at another campus
- [ ] 3. Expiration of a course
- [ ] 4. Change in course number
- [x] 5. Change in course title
- [ ] 6. Change in course credit type
- [ ] 7. Change in course attributes (department head signature only)
- [ ] 8. Change in instructional hours
- [ ] 9. Change in course description
- [ ] 10. Change in course requisites
- [ ] 11. Change in semesters offered (department head signature only)
- [ ] 12. Transfer from one department to another

**PROPOSED:**  
- **Subject Abbreviation**: ASTR  
- **Course Number**: 164  
- **Long Title**: Conceptual Stars and Galaxies  
- **Short Title**: Stars and Galaxies

**EXISTING:**  
- **Subject Abbreviation**: ASTR  
- **Course Number**: 164  
- **Long Title**: Conceptual Stars and Galaxies  
- **Short Title**: Stars and Galaxies

**ABBREVIATED TITLE WILL BE ENTERED BY THE OFFICE OF THE REGISTRAR IF OMITTED.** (20 CHARACTERS ONLY)

**PROPOSED CREDIT TYPE**

<table>
<thead>
<tr>
<th>Credit Type</th>
<th>Value</th>
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<tbody>
<tr>
<td>Fixed Credit: Cr. Hrs.</td>
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<tr>
<td>Variable Credit Range: Minimum Cr. Hrs. (Check One)</td>
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<tr>
<td>Maximum Cr. Hrs.</td>
<td></td>
</tr>
<tr>
<td>Equivalent Credit: Yes</td>
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</tbody>
</table>

**PROPOSED COURSE ATTRIBUTES:**

- [ ] 1. Pass/Not Pass Only
- [ ] 2. Satisfactory/Unsatisfactory Only
- [ ] 3. Repeatable
- [ ] 4. Credit by Examination
- [ ] 5. Fees: [ ] Coop [ ] Lab [ ] Rate Request (Include comment to explain fee)
- [ ] 6. Registration Approval Type: [ ] Department [ ] Instructor

**TERMS OFFERED**

- [x] Fall  
- [x] Spring  
- [ ] Summer

**CAMPUS(ES) INVOLVED**

- [ ] Calumet  
- [ ] Cont Ed  
- [ ] Tech Statewide  
- [x] Ft. Wayne  
- [ ] Indianapolis  
- [ ] N. Control  
- [ ] W. Lafayette

**COURSE DESCRIPTION (INCLUDE REQUISITES/RESTRICTIONS):**  
A descriptive, non-mathematical course in astronomy intended for non-physics majors. It will emphasize physical concepts. Topics include: properties of stars; stellar birth and death; the Hertzsprung-Russell diagram; main sequence stars; binary systems; stellar clusters; red giants and white dwarfs; nova and supernova; neutron stars and black holes; galaxies and the cosmological red shift. Includes required observing sessions. No prerequisites

**COURSE LEARNING OUTCOMES:**

1. Explain how scientific explanations are formulated, tested, and modified or validated.  
2. Distinguish between scientific and non-scientific evidence and explanations.  
3. Apply foundational Physics and Astronomy knowledge and concepts to address issues in stellar evolution and cosmology.  
4. Apply basic astronomical observational methods to gather data and generate evidence-based conclusions.  
5. Use current astronomical models and theories to describe and explain stellar evolution and cosmology.  
6. Locate reliable sources of scientific evidence to construct arguments related to issues in stellar evolution and cosmology.

**Signature Line**

- Calumet School Dean  
- Fort Wayne School Dean  
- Indianapolis School Dean  
- Vice Chancellor for Academic Affairs  
- West Lafayette School Dean  
- West Lafayette Registrar
ASTR 164 Tentative Syllabus
Non-Mathematical Stars and Galaxies
Fall 2014 - 2015

Catalog Description
A descriptive non-mathematical course in astronomy intended for non-physics majors. Topics include properties of stars; stellar birth and death; the Hertzsprung-Russel diagram; main sequence stars; binary systems; stellar clusters; red giants and white dwarfs, nova and supernova; neutron stars and black holes; galaxies and the cosmological red shift.

Credit/Contact Hrs 3/3
Prerequisite Courses None
Co-requisite Courses None

Textbook None

Suggested Materials and Support
An iPad, ($50.00 rental from IPSGA) or other tablet or personal computer.

Suggested apps for the iPad
iSwifter Games Brower ($4.99)
NotesPlus ($7.99)
ChartMakerPro ($3.99)
internet and e-mail access,
access to BlackBoard Learn,

Optional Apps
Pages ($10.99)
In App purchase of Handwriting to text converter for NotesPlus ($1.99)

Laboratory Experience None

Instructor: Dr. Stephen Gillam
Room KT132
Time Monday, Wednesday & Friday 10:00-10:50 am
Office KT122A
Office hours: TBD

Course Outcomes
Students who successfully complete this course will be able to:

4.1 Explain how scientific explanations are formulated, tested, and modified or validated. [BF 5, 6]

4.2 Distinguish between scientific and non - scientific evidence and explanations. [BF 1, 2, 5]
4.3 Apply foundational knowledge and discipline-specific concepts to address issues or solve problems. [BF 2, 5]

4.4 Apply basic observational, quantitative, or technological methods to gather data and generate evidence-based conclusions. [BF 5]

4.5 Use current models and theories to describe, explain, or predict natural phenomena. [BF 2, 5]

4.6 Locate reliable sources of scientific evidence to construct arguments related to real-world issues. [BF 1, 2, 5, 6]

**Contribution to State Outcomes**
This course contributes to the following competency areas:
1. Scientific Ways of Knowing.

**Contribution to IPFW Baccalaureate Framework Goals**
The IPFW Baccalaureate Framework (BF) consists of the following goals:
1. Acquisition of Knowledge
2. Application of Knowledge
3. Personal and Professional Values
4. A Sense of Community
5. Critical Thinking and Problem Solving
6. Communication

This course contributes to BF goals 1-6 shown in the numbers between brackets after each course outcome.

**Learning outcomes for the class.**

Students who successfully complete this course will:
1. Understand the process of scientific enquiry, how scientific theory and law differ, how physical laws differ from civil laws, and the value of an educated guess.

2. Use the distribution of radiation inside a blackbody and knowledge of light propagation to predict the temperatures and luminosities of stars from their colors and distances.

3. Use the HR diagram of the stars in the Milky Way to develop a model of where stars generate energy.

4. Comprehend the four physical forces (gravity, electromagnetism, weak and strong nuclear forces) and their roles in the birth, life and death of stars.
5. Understand how the organization of stars in stars cluster and galaxies, galaxies in clusters, galaxy clusters in giant filaments is determined by the force of gravity and dark matter.

6. Understand how doppler shift of the light from distant galaxies shows us that the space-time fabric of the universe is expanding.

7. Understand how the structure and evolution of the galaxies is affected by the life-cycles of stars.

Warm-ups
These will include multiple-choice concept questions, reading, and numerical problems. These are intended to acquaint you with the concepts needed to discuss topics in class.

Class Activities
These will be investigations using the concepts introduced in the warm-ups. They will include:

1. Work-sheets using the concepts in the pre-class activity.
3. Use the appearances of star clusters to estimate their relative ages
4. PhET simulations using your ipad.
5. Peer review of essays.

Homeworks
These will consist of problems and/or essays. These will include

1-2 page papers at intervals on the following subjects:

- Compare the terms "educated guess" and "speculation"
- How does scientific law differ from civil law
- Compare and contrast Fact and Inference
- Compare and contrast scientific theory and hypothesis
- Compare and contrast scientific theory and scientific law
- What is truth?

Homeworks, pre-class activities and tests must be word-processed (.doc, .docx, or PDF format) and submitted to Blackboard by the due dates.

Pre-class activities will be graded on the basis of completion. Problems and tests will be graded primarily for logical reasoning. Correct answers with wrong or no reasoning will receive zero.

Tests
Midterm: Test of concepts
Final: A 4-6 page report on your research.

Essays (including the final) will be graded as follows.
Grammar 30%
Organization 30%
Logical argument 40%

Your audience is the other students in ASTR 164. NOT the professor. Your essays must be focused and concise.

I will be looking for the following organization of essays.

1. An introduction that briefly lays out what the essay is going to discuss with a brief presentation of your conclusions.

2. A main body that makes the arguments supporting the conclusions you have described in the introduction. These arguments must be presented in an order sensible to the reader. Individual paragraphs must start with a premise and end with a conclusion, arrived at through logical argument.

3. A final section that recapitulates the conclusions.

Research Project
You will use one the physics department’s three 10-inch telescopes, on at least two nights, to make a Hertzsprung-Russell (HR) diagram of at least 50 bright stars in the Milky Way. This will be used to determine each stars stage of evolution.

Your final examination will be a 4-6 page report on this work.

The report must include:

1. An observing log containing the names of the stars observed, when they were observed, and details of the telescope and eyepieces used on each night.

2. A description of the equipment used, methods you employed to get your data, problems encountered, and how you dealt with them.

3. An HR diagram of the stars you observed.

4. Estimates of the evolutionary stage (main sequence, subgiant, giant, etc.) of each observed star

5. Supporting evidence from on-line articles.

Carrying out the project and submitting your observing log is worth 15% of your grade. Reporting it is worth another 20% of your grade.
<table>
<thead>
<tr>
<th>Grading Scheme</th>
<th>Percentage of Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-class activities</td>
<td>10% of grade</td>
</tr>
<tr>
<td>Homework problems</td>
<td>15% of grade</td>
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<tr>
<td>Homework essays</td>
<td>25% of grade</td>
</tr>
<tr>
<td>Midterm</td>
<td>15% of grade</td>
</tr>
<tr>
<td>Research project</td>
<td>15% of grade</td>
</tr>
<tr>
<td>Research report</td>
<td>20% of grade</td>
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