REQUEST FOR ADDITION, EXPIRATION, OR REVISION OF AN UNDERGRADUATE COURSE
(10000-40000 LEVEL)

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
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: 415100
Long Title: Galaxies and Large Scale Structure
Short Title: Galaxies

COURSE DESCRIPTION (INCLUDE REQUIREMENTS/RESTRICTIONS):
The course covers basic observed properties and models of galactic structure, dynamics of stars, physics of the interstellar medium and intergalactic medium, formation of galaxies, properties of clusters of galaxies, and dark matter.

This is a calculus-based course.
Prerequisites: MA26100 grade 2P or better. PHYS34200 grade 2P or better.

COURSE LEARNING OUTCOMES:
To further develop understanding of newtonian gravitation, special and general relativity, electromagnetism, quantum and statistical mechanics, and thermodynamics through their application to galaxy formation and cosmology.

To develop skill in computational physics.
ASTR 45100 Tentative Syllabus  Fall 2014
Galaxies and Large Scale Structure

The course covers basic observed properties and models of galactic structure, dynamics of stars, physics of the interstellar, intergalactic, and intercluster media, formation of galaxies, properties of clusters of galaxies, and dark matter.

You will be required to read selected background material and to lead class discussions on the astronomical observations that motivate each topic. For instance, you may be asked to research the literature, prepare a presentation, and brief the class on the morphological classification of galaxies.

**Instructor:** Stephen Gillam  
**Office:** KT122A  
**Office Hours:** TBD  
**Class room:** TBD  
**Textbook:** TBD

**Prerequisites:**  
PHYS 34200 (Modern Physics) Minimum Grade 2.0

**Tentative Schedule of Topics**  
**Galaxy Basics**  
- Discovery  
- Morphological classification of galaxies  
- Quantitative classification  
- Global properties  
- Luminosity function  
- Observational biases

**Components of Galaxies**  
- The interstellar medium,  
  - Gas and dust in spirals and ellipticals  
  - Stellar populations and dynamics  
  - Young stars and open clusters  
  - Old populations and globular clusters  
  - Star formation indicators

**Starburst systems**  
- Dynamics of galaxies (including central masses)  
- Environmental effects on galaxies  
- Dark matter in galaxies

**Cosmology**  
- The Hubble constant and extragalactic distance scale
Galactic structures used as cosmological distance indicators

Galaxy Groupings
  Compact groups
  Clusters of galaxies

Large scale structure
  Clues to galaxy formation
  The intergalactic medium
  The Hot intracluster gas
  Interactions and mergers of galaxies and clusters
  Dark matter, dark energy, and filaments

Active Galactic Nuclei
  Radio galaxies, quasars, blazars, and AGNs
  AGN emission-lines
  Structure and models
  Relativistic flows - jets, superluminal motion, gamma-ray bursts
  AGN host galaxies

Galaxy Evolution
  AGNs, the galaxy connection

**Homework**
This will consist of a semester-long computational astronomy project to build a galaxy merger simulation. It will be in four graded phases.
1) **Definition of the problem.** This will end with a presentation of the relevant physics in week 4 of the semester.
2) **Development of algorithms,** ending with presentation of the pseudocode in week 6.
3) **Development of the code.** This phase will end with a report on the code development in week 9.
4) **Computations and results.** These will be reported the week before finals week.

Each phase will be worth the same number of points.

**Research Project**
An observational astronomy project using data from the Galaxy Evolution Explorer (GALEX) archive.

**Reports**
You will present your homework and project results in two word-processed reports of 4-10 pages length.
Grading
Class presentations 15%
Midterm 20%
Final 20%
Project 20%
Homework 25%