

**Section 1. Proposed Course Outline** (A general statement of course content that informs class syllabus construction. Once approved, all sections of a given course must include this content, no matter which instructor teaches the course, or the mode of delivery. Divisions must include this new course outline in the Divisional Course Outline binder as required by COPPs.)

Course Number: **ASTR 122** Full Course Title for print catalog: **Stellar Astronomy**

Abbreviated Course Title for Banner: **Stellar Astronomy** (30 character limit)

Prerequisites: Math 52 or higher

Co-requisites:

Grade Option: X Graded (with P/NP option)  [ ]  Pass/No Pass only

|  |  |  |  |
| --- | --- | --- | --- |
| **Number/Type Credits** | **Term Minimum Contact** | **Term Maximum Contact** | **11-Week Term Contact** |
| 2 Lecture | 20 hours (lecture credits x 10) | 24 hours (lecture credits x 12) | 22 hours (lecture credits x 11) |
| 2 Lec/Lab | 40 hours (lec-lab credits x 20) | 48 hours (lec-lab credits x 24) | 44 hours (lec-lab credits x 22) |
|    Lab |    hours (lab credits x 30) |    hours (lab credits x 36) |    hours (lab credits x 33) |
| 4 **Total credits (sum)** | 60 **Total hours (sum)** | 72 **Total hours (sum)** | 66 **Total hours (sum)** |

|  |
| --- |
| **Course Description (300 character limit):** |
| ASTR 122 focuses on the fundamental physic concepts underlying our understanding of stars. How we observe light from stars and our Sun and its place in our Milky Way galaxy begins a comprehensive exploration of the nature of stars, from their birth to multiple paths to maturity and death, including super novae and stellar black holes.       |
| **Course Outcomes and Proficiencies** | **Assessments Planned** |
| What will the student ***know*** or ***be able to do*** at the end of the course?What ***attitudes*** related to the subject will the student hold? | What evidence will demonstrate that students have achieved course outcomes? (assessment tools may include departmental tests, written products, portfolios, juried performances, quizzes and exams, or alternative assessments such as qualitative studies, capstone projects, external reviewers, etc.) |
| **Upon successful completion of this course, the student will:** | **How each outcome will be assessed:** |
| Think and communicate based on familiarity with a wide variety of physical phenomena involving stars and the means by which they are described and explained. | Exams, homework, projects, class/lab activities, journal entries, reading questions, class conversation, online/office hour discussions, student evaluations of the class, reports on subsequent enrollment and performance in other classes. |
| Think and communicate based on familiarity, in part through direct practice, with observational tools, chains of reasoning and exploration and knowledge of scientific methods that are part of the practice of this area of astronomy. | Exams, homework, projects, class/lab activities, journal entries, reading questions, class conversation, online/office hour discussions, student evaluations of the class, reports on subsequent enrollment and performance in other classes. |
| Correctly use scientific reasoning regarding the classification, formation, evolution of stars and their remnants, and think and communicate with a significant i basic conceptual understanding of physical systems involved in the classification, formation, evolution and remnants of stars. | Exams, homework, projects, class/lab activities, journal entries, reading questions, class conversation, online/office hour discussions, student evaluations of the class, reports on subsequent enrollment and performance in other classes. |
| Converse and comprehend through communication using elementary descriptions and dynamical laws involving balance between atomic fusion, gravity and pressure involved in the formation and evolution of stars. | Exams, homework, projects, class/lab activities, journal entries, reading questions, class conversation, online/office hour discussions, student evaluations of the class, reports on subsequent enrollment and performance in other classes. |
| Engage this area of astronomy with an active scientific literacy, which includes use of public resources widely available as part of large scale astronomy investigation. | Exams, homework, projects, class/lab activities, journal entries, reading questions, class conversation, online/office hour discussions, student evaluations of the class, reports on subsequent enrollment and performance in other classes. |
| Think and communicate an elementary understanding of spectroscopy, light and light intensity, and drawing conclusions from observational data about possible explanations of physical properties of stars. | Exams, homework, projects, class/lab activities, journal entries, reading questions, class conversation, online/office hour discussions, student evaluations of the class, reports on subsequent enrollment and performance in other classes. |
| Formulate questions to move their thinking forward concerning the subject matter of the class.  | Exams, homework, projects, class/lab activities, journal entries, reading questions, class conversation, online/office hour discussions, student evaluations of the class, reports on subsequent enrollment and performance in other classes. |
| Think and communicate with a familiarity with elementary applications of basic observational information involving the structures of stars and star-forming systems as well as black holes and other stellar remnants.  | Exams, homework, projects, class/lab activities, journal entries, reading questions, class conversation, online/office hour discussions, student evaluations of the class, reports on subsequent enrollment and performance in other classes. |
| Be aware of possible uses and impacts of this physics knowledge. | Exams, homework, projects, class/lab activities, journal entries, reading questions, class conversation, online/office hour discussions, student evaluations of the class, reports on subsequent enrollment and performance in other classes. |
| Converse and write about the nature of science with increased sophistication and see physics/astronomy as a science, rather than a body of knowledge. | Exams, homework, projects, class/lab activities, journal entries, reading questions, class conversation, online/office hour discussions, student evaluations of the class, reports on subsequent enrollment and performance in other classes. |
| Appreciate that the insights provided by Classical Mechanics, Nuclear Physics, Electricity and Magnetism, and Thermodynamics are valuable and useful even though physics has developed beyond Classical Mechanics and beyond mechanical theories - of which Classical Mechanics is a premier example. | Exams, homework, projects, class/lab activities, journal entries, reading questions, class conversation, online/office hour discussions, student evaluations of the class, reports on subsequent enrollment and performance in other classes. |
| Appreciate current efforts to create new insights in this area of astronomy and have a sense of currently open questions within the astrophysics community. | Exams, homework, projects, class/lab activities, journal entries, reading questions, class conversation, online/office hour discussions, student evaluations of the class, reports on subsequent enrollment and performance in other classes. |

**Course Content by Major Topics**What topics will be presented? What are the main activities of the course? What are the central themes?

(See sample at <http://www.lanecc.edu/copps>

**Topics:**

Radiation: Information from the cosmos

* What we can tell from starlight and how light is measured
* The electromagnetic spectrum
* Properties of light waves and waves in general
* Travel of light waves without a medium to travel through
* Blackbody spectra
* Doppler Effect

Spectroscopy and atomic energy transitions

* Spectral lines
* Atomic structure
* Formation of emission and absorption lines
* Distinction between emission lines and a continuous spectrum
* Molecular lines versus atomic lines

The sun

* Structure and physical properties such as magnetic field and sunspots
* Storms and surface events; effect on Earth
* Source of energy
* Solar neutrinos and implications

Stars and their types

* Main sequence stars and other parts of the HR diagram
* Stellar motion
* Distance to stars
* Luminosity, apparent brightness, absolute brightness, and magnitude
* Stellar sizes
* Stellar temperatures and colors
* Stellar masses and lifetimes

The interstellar medium

* Distribution of gas and dust
* Emission nebulae
* Dark dust clouds
* 21 cm radiation (and radio astronomy)
* Cold molecular clouds

Star formation

* Star forming regions
* Formation models for solar mass stars and processes
* Stars of various masses and different formation processes
* Observations of cloud fragments and protostars
* Role of shock waves
* Star clusters

Stellar evolution

* Leaving the main sequence
* Evolution of a solar mass star
* Evolution of very massive stars
* White dwarfs
* Type II supernovae
* Observing evolution in star clusters
* Evolution of binary systems/Type I supernovae

Stellar explosions

* Novae – Life after death of white dwarfs
* Supernovae
* Formation of heavy elements
* The cycle of stellar evolution

Neutron stars and black holes

* Neutron stars
* Pulsars
* Neutron star binaries
* Gamma ray bursts
* Black holes
* Special and general relativity
* Travel near black holes
* Observational evidence and locations

**Section 2. Proposal Information**

|  |  |  |
| --- | --- | --- |
| **Course Developer:** | **Type of Proposal** | **Type of Course:**  |
| Dennis Gilbert |  New course | X Lower Division Collegiate (transfer)  |
| Date: 11-28-2015 |  [ ]  Currently 199 or 299  | [ ]  Professional/Technical (required or elective)  |
| Catalog year to take effect:  | [ ]  Experimental Course | [ ]  Developmental, numbered below 100 |
| 2014-2015\_\_\_  |  [ ]  199 Special Studies |  |
| 2015-2016\_X\_\_  |  [ ]  299 Trends  |  |
|  | [ ]  Revised course (If increasing credits, use credit change form) |
|  | [ ]  Reactivated course with no change |
|  | X[ ]  Reactivated course with changes  |

**Rationale:**

|  |
| --- |
| How does this proposal further the goals of the program or department?  |
| The course offers a largely conceptual introduction to an area of physics that is crucial to basic understanding and a robust arena of investigation on the frontiers of physics. Besides providing breath in the physics program, the course is in an area of popular interest, which will provide a steady stream of enrollment; and this will balance the lack of high enrollment later in sequences serving science and engineering majors due to attrition. This course is a revision of the previous ASTR 121, which was a lecture course. The course will incorporate lab activities and meet lab course requirements, further meeting the needs of students. In addition, the lab element of the course helps establish astronomy and physics as science, which is a process rather than a body of knowledge. Work is underway to create a Space Sciences bachelor’s degree in Oregon OUS schools and an Associate of Science – Space Studies degree at Oregon community colleges. The ASTR 121,2,3 sequence will be part of those efforts. The division of subject matter into the subdivisions as used in ASTR 121,2,3 is common where primarily conceptual year-long college study is available in a quarter system, thus aligning our program with other programs. Articulation with other schools, e.g. the University of Oregon, is expected. |
| What assessment evidence supports this proposal?  |
| The pedagogical approach of this course is informed by nearly three decades of curriculum developed around interactive engagement by students, which is also an increasing element of astronomy education. These approaches have led to increases in conceptual understanding several standard deviations above traditional lecture pedagogy. While traditional “cookbook” labs have been shown to be as comparably ineffective as the passive lecture environment, new approaches to lab activities are being developed and practiced. The lab activities in this course and series will heavily borrow from lab activities considered on the leading edge of astronomy education. Further the lab activities are incorporated into this course and the series in a lecture-lab format rather than a lecture + lab format to facilitate more productive integration of lab-like and lecture-like activity. Further, the course emphasizes a curriculum approach to develop an active science literacy that provides skills in using astronomy resources available to the lay science public. |
| How do you know there is a demand for this course?  |
| ASTR 121, 122 and 3 courses (without the lab component) were consistently popular at Lane, and the similar series at the University of Oregon is popular. This fall at the UO, enrollment in ASTR 121,122 and 123 classes was 650 students, and plausibly 2000 for the year. The newly incorporated lab component of the course will not only enhance the class as a science experience for students, but satisfy lab science requirements for degrees and certificates, including the AAOT and OTM transfer degrees. Due to the added lab component, greater interest and demand than in the past is plausible. The course will also play a role in the Space Studies pathway in Oregon, for which demand has been recognized. |

**Section 3. Curriculum Equity** [**http://www.lanecc.edu/copps**](http://www.lanecc.edu/copps)

**To promote an environment where all learners are encouraged to develop their full potential, this course will support Lane’s Curriculum Equity policy in the following way(s):**

The astronomy curriculum lead will regularly review the curriculum equity guidelines and pay attention to the wider literature regarding curriculum equity. For this course and series in particular, attention will be paid to the following in the implemented curriculum:

a. Efforts to ameliorate stereotype threat in the learning environment;

b. Care to create culturally appropriate assignments, resources and feedback that promote learning for all students;

c. Use of globally diverse reference materials and integrated reference to the globally diverse practice of astronomy and astronomy collaboration, with materials (e.g. photographs, videos) that challenge bias;

d. Reference to inappropriate bias in the practice and organization of astronomy (e.g. sexism during much of the 20th Century) and to artifacts of cultural/political dominance (e.g. names of Constellations).

e. Use of interactive engagement pedagogy that generally supports inclusion and success in the class;

f. Creation of awareness of college life and work to provide inclusive support for non-traditional students.

g. Creation of math remediation materials that support students in a variety of states of math preparation.

h. Preference and support for learning community links to the course that support students for which astronomy is an interest but also a stretch from what they are more comfortable in learning.

**Section 4. For revised courses only: PREVIOUS Catalog/Course Information:**

Course Number: Course Title in Banner: (30 characters maximum)

Full Course Title in print catalog:

Prerequisites:

Co-requisites:

Grade Option: [ ]  Graded (with P/NP option) [ ]  Pass/No Pass only

|  |  |  |  |
| --- | --- | --- | --- |
| **Number/Type Credits** | **Term Minimum Contact** | **Term Maximum Contact** | **11-Week Term Contact** |
|    Lecture |    hours (lecture credits x 10) |    hours (lecture credits x 12) |    hours (lecture credits x 11) |
|    Lec/Lab |    hours (lec-lab credits x 20) |    hours (lec-lab credits x 24) |    hours (lec-lab credits x 22) |
|    Lab |    hours (lab credits x 30) |    hours (lab credits x 36) |    hours (lab credits x 33) |
|    **Total credits (sum)** |     **Total hours (sum)** |     **Total hours (sum)** |     **Total hours (sum)** |

**Course Description:**

What will change? [ ] Course Number [ ] Title [ ] Course Description [ ] Credit hours [ ] Contact hours

**Section 5. Support Courses (New Professional/Technical course proposals must complete.)**

Professional/Technical courses are tracked within programs for purposes of Carl Perkins funding and budgetary planning. Indicate all degree or certificate programs for which this course will be required.

|  |  |
| --- | --- |
| Program | Division |
|       |       |
|       |       |

**Section 6. Overlap Courses (New course proposals must complete.)**

While overlap of course materials is not necessarily a flaw, duplication of course materials may lead to inefficient use of college resources. If there is overlap, the faculty of overlapping courses must agree on the extent of overlap and attach a rationale explaining its necessity if it is more then 10%.

Indicate all departments/courses that this course may overlap. Division Dean of existing course enters one of two options at right. Note: N/A is not an option.

Options:

1. No overlap.

2. Approved: overlap is acceptable. Rationale attached.

3. Disapproved: reasons attached.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Division | Course Number / Title | % Overlap | Option | Division Dean of existing course(Signature required for all options) | Date |
| Science | ASTR 107 | 15 |       |  |       |
|       |       |       |       |  |       |

**Section 7. Qualification to fulfill degree requirements** (complete all relevant forms, available at <http://www.lanecc.edu/currsched/curriculum-forms> and send to Curriculum/Scheduling for the Degree Requirements Review Committee):

[ ]  Form(s) applying for the following degree requirement status have been attached. (Only check this box when forms have been completed and attached.)

**AAOT, ASOT-Bus, OTM:**

[ ]  Arts & Letters

[ ]  Social Sciences

X Science /Computer Science

[ ]  Mathematics

[ ]  Cultural Literacy Option

(please submit with course syllabus to Michael Samano in Social Science)

**All degrees:**

[ ]  Health/Wellness/Fitness

**AAS, 1-year and 2-year certificates:**

[ ]  Human Relations

**Optional designation:**

[ ]  Sustainability status

**Section 8. Library Impact Statement**

Under accreditation standards, Library consultation is essential for new programs, new courses and for substantively revised courses when the revisions entail any change in library use.

**What assignments will require the use of library and information resources?**

Reports making use of lay science/astronomy publications, requiring student access to such publications. Such assignments will be structured to mitigate against damage to such publications. Access could include computer stations and wi fi access in appropriate facilities for study. Access could also include collections of hard copy materials connected to the course and series for use in the library facility.

Each academic area has a Liaison Librarian <http://www.lanecc.edu/library/services/liaison.htm>. Contact the designated librarian to discuss the library needs of your course. Please allow the librarian at least one week to assess library resources.

**To be completed by Liaison Librarian:**

[ ]  Library resources are adequate to support this proposal.

[ ]  Additional resources are needed but can be obtained from current funds.

[ ]  Significant additional Library funds/resources are required to support this proposal.

 Liaison Librarian Date

**Section 9. Divisional Approval** (To be completed by Division Chair and Administrative Assistant)

**Human, Physical, and Financial Resources:**

[ ]  Additional instructional costs (staff, materials, services or facilities) will be incurred to offer this course. Source of funding:

[ ]  No additional instructional resources (staff, materials, services or facilities) are needed to offer this course.
Explain:

**Required Certifications:**

[ ]  We have developed minimum course certification standards according to the COPPs procedure “Instructor Qualifications: Credit,” to be filed with ASA upon course approval.

[ ]  We have completed faculty certification form(s) for faculty qualified to teach this course, to be filed with ASA and Human Resources upon course approval.

Administrative Assistant/Coordinator Date

**Fees:**

[ ]  We have completed fee rationale and fee request forms to be submitted to ASA upon course approval, in compliance with the COPPs procedure, “Fees: Special”

[ ]  No special fees will be required for this course.

**Divisional Recommendation:**

[ ]  The Academic Dean and Administrative Assistant have reviewed this course proposal and kept a copy for divisional files.

[ ]  Faculty review of this course was completed within the division on      (date).

[ ]  Pass [ ]  Do Not Pass

Academic Dean Date

**Section 10. College Approval**

Curriculum Committee Chair Date Executive Dean for Academic Affairs Date

Curriculum Approval Committee hearing:       \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 Date Vice President for Academic & Date

 Student Affairs

Section 6 Attachment

Each of ASTR 121,122 and 123 will overlap with approximately 15% of ASTR 107, since ASTR 107 is a summary of the material of ASTR 121,122 and 123 and ASTR 107 also includes a lab component. In subject matter category, ASTR 107 overlaps with approximately 30% of the ASTR 121,122and 123 courses; however, the courses in the sequence are deeper and cumulatively richer in content that is expected to be understood and used by the student after successfully completing the ASTR 107 course. Thus the overlap is more reasonably 15% or less. With the labs now added to ASTR 121,122and 123, plausibly completing the whole sequence would fully overlap ASTR 107; however, students completing the whole sequence would not need the ASTR 107 science credit for any transfer purposes, as that would be accomplished by the ASTR 121,122and 123 sequence. Other than this case, the overlap of ASTR 107 with any one or two courses of ASTR 121,122 or 123 is not sufficient to prohibit use of ASTR 107 on the basis of overlap. A student in this situation most likely would have taken ASTR 107 before taking any two of ASTR 121,122, or 123. Once successfully completing one course in this sequence, it is recommended that students be encouraged to take one or more of the terms in the sequence rather than ASTR 107.