



The Solar System (ASTRO 100)

Fall 2023
SCI 04406/L



BALL STATE
UNIVERSITY

Instructor



Dr. Krista Hook

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Office Hours:

Monday:	2pm – 5pm
Tuesday:	By Appointment
Wednesday:	2pm – 5pm
Thursday:	12pm – 3pm
Friday:	2pm – 5pm
Email me for alternative times.	

Course

Required Materials	<ul style="list-style-type: none"> • Astronomy – OpenStax (Online Text) <ul style="list-style-type: none"> ◦ https://openstax.org/details/books/astronomy • Computer Access w/ Internet • 1 three-ring binder 	
Meeting Times	MWF: 1:00pm – 2:00pm (Class) T: 6:00pm – 8:00pm (Lab)	
BSU Credits	Ball State University: College of Science and Humanities: Department of Physics and Astronomy Course Credits: 3 / Course Name: ASTRO 100	
Course Requirements and Specifications	Prerequisite: None Co-requisite: The Solar System Lab (SCI4406L)	Credit: 1.5 credits Offered: Fall

Course Content Overview

Welcome to Solar System Astronomy!

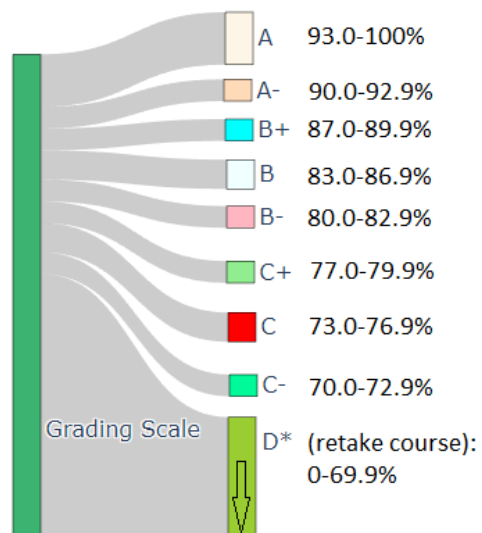
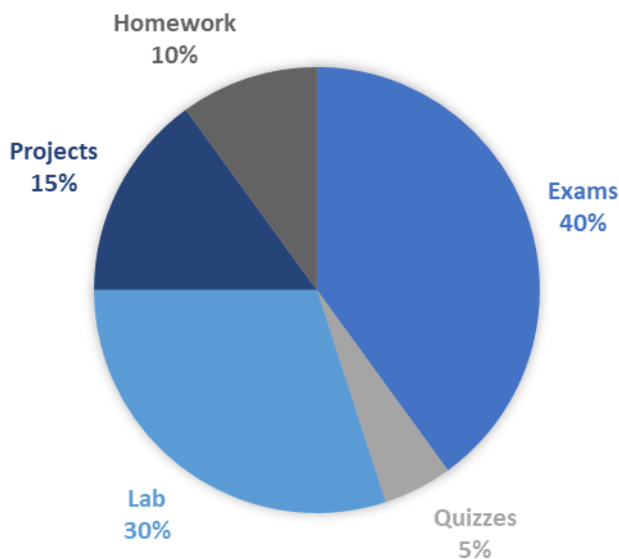
Solar System Astronomy is a one semester introductory survey course in Astronomy and Planetology. Astronomy is an amazing subject that allows one to observe and understand the beauty of the Universe beyond our world.

This course is a survey of the solar system based on modern data obtained from NASA and ESA probes, along with other missions conducted by foreign space agencies. Students are introduced to the basic concepts of planetary science that includes elements of geology and meteorology concepts. The planets, their satellites, other space objects in the solar system, and the sun are examined in detail from a planetary science point of view. In addition, the general motions of bodies in the solar system are examined.

In this course, we will take a brief look at the constellations and discuss how astronomers define different coordinate systems. We will look closely at the Solar System and discuss how it, the planets, and the other bodies within the Solar System formed. We will also discuss other stars, galaxies and briefly introduce cosmology, a topic covered more in depth in the spring semester course.

* Ball State University offers 3 college credit hours to students in ASTRO 100 to students who complete this course. Refer to the Dual Credit section for details on enrollment and fees.

Grade Calculation & Scale

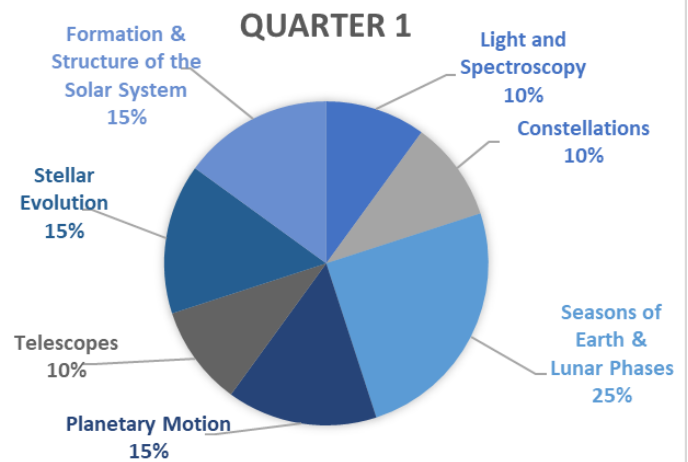


Course Content & Mastery Goals for Exams

Exams, including the final exam, will be parsed into mastery goals for grade calculations. These parsed categories are listed below for the first and second quarters of the semester, respectively. The benefit of assessing and grading in this way is to afford students the opportunity to provide evidence of learning of a concept (such as Spectroscopy) multiple times and not allow previous, less successful attempts to haunt their final grade for the course. A final grade should reflect what a student KNOWS, independent of their journey to get there.

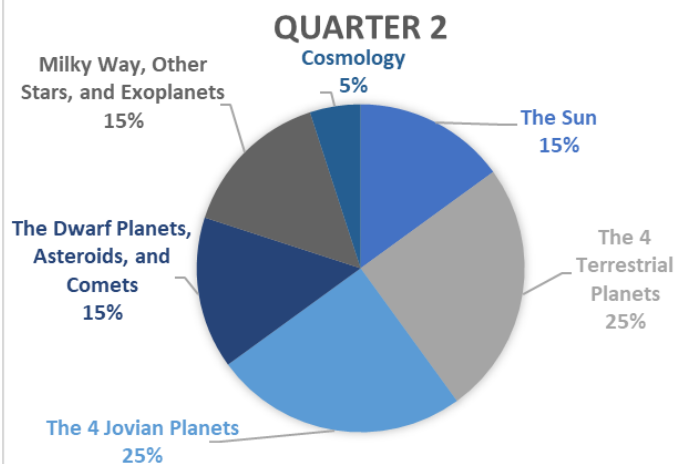
Quarter 1 Concepts

Light and Spectroscopy	10
Constellations	10
Seasons of Earth & Lunar Phases	25
Planetary Motion	15
Telescopes	10
Stellar Evolution	15
Formation & Structure of the Solar System	15
	100%



Quarter 2 Concepts

The Sun	15
The 4 Terrestrial Planets	25
The 4 Jovian Planets	25
The Dwarf Planets, Asteroids, and Comets	15
Milky Way, Other Stars, and Exoplanets	15
Cosmology	5
	100%



Fall 2023 Tentative Semester Schedule*

*When Naked Eye and Telescope Astronomy (Weather Permitting) Lab Times are not permitted by weather, the class will still meet in usual room

Week	Lecture	Lab
1 Aug 14 – 18	PB&Js & Constellations	Sky Observation Lab Naked Eye Astronomy (Weather Permitting)*
2 Aug 21 – 25	The Sky & Planetary Motion Structure & Form of the Solar System	Constellation Project / Presentations Size of Space Lab
3 Aug 28 – Sept 1	REVIEW FOR EXAM 1	EXAM 1: Constellations, Formation/Structure of the Solar System, & Planetary Motion
4 Sept 6 – 8	The Sun	No Lab (LABOR DAY)
5 Sept 11 – 15	The Moon	Solar & Lunar Lab Naked Eye Astronomy (Weather Permitting)*
6 Sept 18 – 22	Earth's History	Geological Timeline Project Rock Cycle Lab
7 Sept 25 – 29	Earth's Seasons	Seasons Lab Naked Eye Astronomy (Weather Permitting)*
8 Oct 2 – 6	REVIEW FOR EXAM 2 Mastery Exam Available for Exam 1	EXAM 2: Seasons, Lunar Phases, Lunar/Solar Eclipses, Earth
9 Oct 9 – 13	Light, Spectroscopy, & the HR Diagram	No Classes - Monday 10/09/2023 (FALL BREAK) - Tuesday 10/10/2023 (FALL BREAK) - Wednesday 10/11/2023 (PSATs) Thursday 10/12/2023 is scheduled as a <u>Tuesday</u> (Thursday / Tuesday Swap Day)
10 Oct 16 – 20	Telescopes & Near Earth Objects REVIEW FOR EXAM 3 Mastery Exam Available for Exam 1 & 2	EXAM 3: Light, Spectroscopy, HR Diagram, & Telescopes
11 Oct 23 – 27	Milky Way & Other Stars / Solar Systems The Sun & Stellar Evolution	Habitable Planet Search Lab Naked Eye Astronomy (Weather Permitting)*
12 Oct 30 – Nov 3	REVIEW FOR EXAM 4 Mastery Exam Available for Exam 1 - 3	EXAM 4: Milky Way, Stars, The Sun, & Stellar Evolution
13 Nov 6 – 10	Mercury & Venus	Space History: Venus Naked Eye Astronomy (Weather Permitting)*
14 Nov 13 – 17	Mars	Space History: Mars Naked Eye Astronomy (Weather Permitting)*
15 Nov 20 – 24	THANKSGIVING BREAK	No Lab (T-DAY BREAK) No Class (T-DAY BREAK)
16 Nov 27 – Dec 1	Beyond Mars – The Jovian Planets, Asteroids, & Dwarf Planets	Space History: Jupiter, Europa, Saturn, & Titan Naked Eye Astronomy (Weather Permitting)*
17 Dec 4 – 8	REVIEW FOR EXAM 5 Mastery Exam Available for Exam 1 - 4	EXAM 5: Terrestrial Planets, Jovian Planets, Dwarf Planets, Asteroids, Comets, & Space History

18 Dec 11 – 14	Brief Intro to Cosmology Mastery Exam Available for Exam 1 - 5	Space History: Uranus, Neptune, the 5 Dwarf Planets, Comets, & Asteroids
19 Dec 15, 18 – 20	FINALS WEEK	Extra Credit Due ALL assignments & makeups DUE

Astronomical Events Visible with the Naked Eye – Fall 2023*

*This will be updated frequently as needed

Week	Event Date	Event
1 Aug 14 – 18	August 12 – 13 (peak)	Perseids Meteor Shower. The Perseids is one of the best meteor showers to observe, producing up to 60 meteors per hour at its peak.
	August 16	New Moon. The Moon will located on the same side of the Earth as the Sun and will not be visible in the night sky.
2 Aug 21 – 25		
3 Aug 28 – Sept 1	August 27	Saturn at Opposition. The ringed planet will be at its closest approach to Earth and its face will be fully illuminated by the Sun. It will be brighter than any other time of the year and will be visible all night long.
	August 31	Full Moon, Supermoon, Blue Moon. The Moon will be located on the opposite side of the Earth as the Sun and its face will be fully illuminated. This phase occurs at 01:37 UTC. This is also the third of four supermoons for 2023. The Moon will be near its closest approach to the Earth and may look <u>slightly</u> larger and brighter than usual. Since this is the second full moon in the same month, it is sometimes referred to as a blue moon.
4 Sept 6 – 8		
5 Sept 11 – 15	September 15	New Moon. The Moon will located on the same side of the Earth as the Sun and will not be visible in the night sky.
6 Sept 18 – 22	September 22	Mercury at Greatest Western Elongation. The planet Mercury reaches greatest western elongation of 17.9 degrees from the Sun. This is the best time to view Mercury since it will be at its highest point above the horizon in the morning sky. Look for the planet low in the eastern sky just before sunrise.
	September 23	Autumnal Equinox. The September equinox occurs at 06:43 UTC. The Sun will shine directly on the equator and there will be nearly equal amounts of day and night throughout the world. This is also the first day of fall (autumnal equinox) in the Northern Hemisphere and the first day of spring (vernal equinox) in the Southern Hemisphere.
7 Sept 25 – 29	September 29	Full Moon, Supermoon. The Moon will be located on the opposite side of the Earth as the Sun and its face will be fully illuminated. This phase occurs at 09:59 UTC. This full moon was known by early Native American tribes as the Corn Moon because the corn is harvested around this time of year. This moon is also known as the Harvest Moon. The Harvest Moon is the full moon that occurs closest to the September equinox each year. This is also the last of four supermoons for 2023.

		The Moon will be near its closest approach to the Earth and may look <u>slightly</u> larger and brighter than usual.
8 Oct 2 – 6		
9 Oct 9 – 13	October 8 – 9 (peak)	Draconids Meteor Shower. The Draconids is a minor meteor shower producing only about 10 meteors per hour. It is produced by dust grains left behind by comet 21P Giacobini-Zinner, which was first discovered in 1900. The best viewing is in the early evening. The shower runs annually from October 6-10 Meteors will radiate from the constellation Draco, but can appear anywhere in the sky.
	October 14	New Moon. The Moon will located on the same side of the Earth as the Sun and will not be visible in the night sky. Annular Solar Eclipse. An annular solar eclipse occurs when the Moon is too far away from the Earth to completely cover the Sun. This results in a ring of light around the darkened Moon. The eclipse path will begin in the Pacific Ocean off the coast of southern Canada and move across the southwestern United States and Central America, Columbia, and Brazil. A partial eclipse will be visible throughout much of North and South America. https://eclipse.gsfc.nasa.gov/SEplot/SEplot2001/SE2023Oct14A.GIF
10 Oct 16 – 20	October 20 – 21 (peak)	Orionids Meteor Shower. The Orionids is an average shower producing up to 20 meteors per hour at its peak. It is produced by dust grains left behind by comet Halley, which has been known and observed since ancient times. The shower runs annually from October 2 to November 7. It peaks this year on the night of October 20 and the morning of October 21. Best viewing will be from a dark location after midnight. Meteors will radiate from the constellation Orion, but can appear anywhere in the sky.
11 Oct 23 – 27	October 23	Venus at Greatest Western Elongation. The planet Venus reaches greatest eastern elongation of 46.4 degrees from the Sun. This is the best time to view Venus since it will be at its highest point above the horizon in the morning sky. Look for the bright planet in the eastern sky before sunrise.
	October 28	Full Moon. The Moon will be located on the opposite side of the Earth as the Sun and its face will be fully illuminated. This phase occurs at 20:25 UTC. This full moon was known by early Native American tribes as the Hunters Moon because at this time of year the leaves are falling and the game is fat and ready to hunt. This moon has also been known as the Travel Moon and the Blood Moon.
	October 28	Partial Lunar Eclipse. A partial lunar eclipse occurs when the Moon passes through the Earth's partial shadow, or penumbra, and only a portion of it passes through the darkest shadow, or umbra. During this type of eclipse a part of the Moon will darken as it moves through the Earth's shadow. NOT visible from Indiana Visible from Europe, Africa, some of Australia, and most of Asia
	November 3	Jupiter at Opposition. The giant planet will be at its closest approach to Earth and its face will be fully illuminated by the Sun. It will be brighter than any other time of the year and will be visible all night long.

12 Oct 30 – Nov 3		This is the best time to view and photograph Jupiter and its moons. A medium-sized telescope should be able to show you some of the details in Jupiter's cloud bands. A good pair of binoculars should allow you to see Jupiter's four largest moons, appearing as bright dots on either side of the planet.
13 Nov 6 – 10	November 4 – 5 (peak)	Taurids Meteor Shower. The Taurids is a long-running minor meteor shower producing only about 5-10 meteors per hour. It is unusual in that it consists of two separate streams. The first is produced by dust grains left behind by Asteroid 2004 TG10. The second stream is produced by debris left behind by Comet 2P Encke. The shower runs annually from September 7 to December 10. The best viewing will be just after midnight from a dark location far away from city lights. Meteors will radiate from the constellation Taurus but can appear anywhere in the sky.
14 Nov 13 – 17	November 13	New Moon. The Moon will be located on the same side of the Earth as the Sun and will not be visible in the night sky.
15 Nov 20 – 24	THANKSGIVING BREAK November 17 – 18 (peak)	Leonids Meteor Shower. The Leonids is an average shower, producing up to 15 meteors per hour at its peak. This shower is unique in that it has a cyclonic peak about every 33 years where hundreds of meteors per hour can be seen. That last of these occurred in 2001. The Leonids is produced by dust grains left behind by comet Tempel-Tuttle, which was discovered in 1865. The shower runs annually from November 6-30. Best viewing will be from a dark location after midnight. Meteors will radiate from the constellation Leo, but can appear anywhere in the sky.
16 Nov 27 – Dec 1	November 27	Full Moon. The Moon will be located on the opposite side of the Earth as the Sun and its face will be fully illuminated.
17 Dec 4 – 8	December 4	Mercury at Greatest Eastern Elongation. The planet Mercury reaches greatest eastern elongation of 21.3 degrees from the Sun. This is the best time to view Mercury since it will be at its highest point above the horizon in the evening sky. Look for the planet low in the western sky just after sunset.
18 Dec 11 – 15	December 12	New Moon. The Moon will be located on the same side of the Earth as the Sun and will not be visible in the night sky.
	December 13 – 14 (peak)	Geminid Meteor Shower. The Geminids is the king of the meteor showers. It is considered by many to be the <u>best shower</u> in the heavens, producing up to 120 multicolored meteors per hour at its peak. It is produced by debris left behind by an asteroid known as 3200 Phaethon, which was discovered in 1982. The shower runs annually from December 7-17. This should be a great year for the Geminids. Best viewing will be from a dark location after midnight. Meteors will radiate from the constellation Gemini but can appear anywhere in the sky.
19 Dec 18 – 22	December 21 – 22 (peak)	Ursids Meteor Shower. The Ursids is a minor meteor shower producing about 5-10 meteors per hour. It is produced by dust grains left behind by comet Tuttle, which was first discovered in 1790. The shower runs annually from December 17-25. It peaks this year on the night of the 21st and morning of the 22nd. The waxing gibbous moon will block out most of the faintest meteors this year. But if you are patient, you should still be able to catch a few good ones. Best viewing will be just after midnight from a dark location far away from city lights.

		Meteors will radiate from the constellation Ursa Minor, but can appear anywhere in the sky.
Winter Break	December 22	Winter Solstice. The December solstice occurs at 03:21 UTC. The South Pole of the earth will be tilted toward the Sun, which will have reached its southernmost position in the sky and will be directly over the Tropic of Capricorn at 23.44 degrees south latitude. This is the first day of winter (winter solstice) in the Northern Hemisphere and the first day of summer (summer solstice) in the Southern Hemisphere.
	December 27	Full Moon. The Moon will be located on the opposite side of the Earth as the Sun and its face will be fully illuminated. This phase occurs at 00:34 UTC. This full moon was known by early Native American tribes as the Cold Moon because this is the time of year when the cold winter air settles in and the nights become long and dark. This moon has also been known as the Long Nights Moon and the Moon Before Yule.

Classroom Policies*
*Subject to change as the need arises.
Laptop Policy
While in class or lab, please keep computer use restricted to classroom-relevant tasks. Laptops or tablets <u>are required</u> for lab sessions. Laptops or tablets are also <u>required</u> for some homework, quizzes, and other activities. Laptops or tablets are permitted but <u>not required</u> during class for note-taking or other class-related needs.
Withdrawal Deadlines
If you wish to drop your class(es), you must do so by August 27, 2023. The withdrawal deadline is October 2023 and will be announced once published by the University Registrar. Dropping/Withdrawing from a class at your high school does not drop/withdraw you from your BSU Dual Credit class. Instructions for dropping/withdrawing can be found in the Dual Credit Student and Parent Handbook.
Attendance Policy
Students arriving after the start of class may receive a Tardy. Students arriving after 20 minutes (or not at all!) may receive an Absence. Student is responsible for all information missed due to not being present.
Late Work Policy
Late work is defined as work that is submitted more than 24 hrs late. Any work not submitted automatically is scored as a zero (0 pts.). If work is submitted but it has been more than 24 hrs since it was due, the work will be graded with a 50% deduction of points in the gradebook, regardless of delay or reason. Last day to submit late work will be the Friday BEFORE finals week. After this time, all zeroes (0 pts.) will remain and cannot be made-up or submitted for points.
Make-up Policies
Make-up exams may only be taken if the student received an excused absence for the missed test. There are no make-ups for Labs. The lowest Lab grade will be exempted at the end of the semester.

Additional Points

Email me one, school-appropriate, cute photo of a pet (if pet is not your pet, please acquire permission to photograph and submit before doing so). These photos will be presented to the class during the in-class final exam review. Deadline: The Friday BEFORE finals week each semester. Worth +1% in Exam Category.

Observation Notebook

Throughout the semester, students will be given star charts to be used for their Observation Notebook. This will be a combination of tables and star charts. This observation notebook will be used for various purposes throughout the semester.

This will count as a project grade.
A 3-ring binder is required.

Resources Available to You

The Writing Center

All writers improve with practice and feedback, so as a student in this course, you are encouraged to use the Writing Center (in Robert Bell 295, Bracken Library, or online) to get additional feedback on your writing. To schedule a free appointment to discuss your writing, go to www.bsu.edu/writingcenter.

Online and in-person appointments are available seven days a week; however, plan ahead because appointments book quickly!

The Learning Center

The Learning Center offers free Tutoring and Academic Coaching for many courses at Ball State. Students can make appointments for online (Zoom) or in-person (NQ 350) appointments. Unvaccinated students are required to wear masks and practice physical distancing in the Learning Center.

To make an appointment, visit my.bsu.edu and click on "TutorTrac" in the Additional Tools section, or just go directly to <https://ballstate.go-redrock.com>.

Testing accommodations for students with disabilities are available for students who have received the appropriate documentation from Disability Services. Tests may be administered in the Learning Center.

Supplemental Instruction is available in select courses. If you have an SI leader for your course, that person will provide students with information the first week of school regarding weekly study sessions.

For more information about all of our programming, visit <https://bsu.edu/learningcenter> or call (765) 285-1006.

Important Information You May Need to Know

Dual Credit-High School Credit Policy Statement

Students may choose to enroll in Ball State's Dual Credit Program to earn college credit for ASTR 100, Introductory Astronomy: A Study of the Solar System and Beyond, from Ball State at a reduced rate of tuition (\$250 flat rate). Students who are eligible for free or reduced lunch this academic year may enroll at no charge if verified by the school.

To enroll in Ball State's Dual Credit Program, students should have a 3.0 GPA on a 4.0 scale and complete the application & registration process before the given deadline. Ball State will bill students via postal mail; no money should be submitted to the high school. College credit can only be earned during the semester (or, in the case of year-long classes, during the academic year) in which the student is enrolled. Late enrollments are not permitted.

Whether college credit earned through dual credit courses will be accepted by another institution of higher education is determined by the college or university to which a student is seeking admission. Before enrolling through Ball State's Dual Credit Program, students should check directly with that institution to determine if a course will be accepted and how it will be counted toward graduation requirements. Refunds will not be issued if Ball State credits are not able to be transferred. In most cases, students will need to earn a C or better to transfer credit from Ball State to another institution. Grades of D or lower earned in Ball State Dual Credit courses are recorded on a student's Ball State transcript but may not be able to transfer.

The rigor of this course will be periodically reviewed by Ball State University faculty in an effort to maintain the high quality of education that each student receives. To learn more about Ball State's Dual Credit Program, visit bsu.edu/dualcredit, call 765-285-1581 or email dualcredit@bsu.edu.

Indiana Academy Diversity Statement

The Indiana Academy for Science, Mathematics, and Humanities is committed to being an inclusive educational community that values diversity in policy and practice. We aim to foster an educational environment where students, faculty, and staff exchange ideas freely, engage in critical thinking, and reexamine their personal perspectives. To create an environment where this respectful and productive dialogue is possible, we do not allow discrimination on the basis of race, ethnicity, sex, geographic origin, gender, gender identity, sexual orientation, disability, religion, age, or nationality. The affirmation, appreciation, and inclusion of multiple cultures ensures that all students, faculty, staff, and the wider Indiana Academy community will be able to thrive in our multicultural academic and residential environment.

Ball State University aspires to be a university that attracts and retains a diverse faculty, staff and student body. We are committed to ensuring that all members of the community are welcome through valuing the various experiences and worldviews represented at Ball State and among those we serve. We promote a culture of respect and civil discourse as expressed in our Beneficence Pledge. For Bias Incident Response information or to report a bias-based incident, please click here or e-mail reportbias@bsu.edu.

BSU Student Rights and Responsibilities

While enrolled in Ball State's Dual Credit Program, you are expected to abide by the academic rules of behavior befitting a university student. You should read the Dual Credit Student and Parent Handbook, located at <https://bsu.edu/dualcredit>

In particular, review the Code of Student Rights and Responsibilities, focusing on the policies regarding student rights and responsibilities, behavior, academic integrity, and related procedures.

The Dual Credit Student and Parent Handbook includes information regarding student qualifications, prerequisites, available courses, responsibilities, financial aid stipulations, transferability, withdrawal, refund and billing policies and more. It is important that you review the information contained in it.

Policy on the Americans with Disabilities Act (ADA)

If you need course adaptations or accommodations because of a disability, please contact the Office of Disability Services. The Office of Disability Services coordinates services for students with disabilities; documentation of a disability needs to be on file in that office before any accommodations can be provided. Disability services can be contacted at 765-285-5293 or dsd@bsu.edu.

Title IX – Sexual Misconduct

Ball State University is committed to establishing and maintaining an effective, safe, and nondiscriminatory educational environment in which all individuals are treated with respect and dignity. For information about Ball State University's Interim Title IX Policy and Procedures, please visit our website. Please note that the University's policy and procedures have undergone significant revisions starting with the 2020-21 school year and ongoing.

Consistent with the University's Notice of Nondiscrimination and in accordance with the U.S. Department of Education's implementing regulations for Title IX of the Education Amendments of 1972 ("Title IX"), Ball State University prohibits sexual harassment that occurs within its education programs and activities.

This prohibition extends to all applicants for admission or employment and to all students (any status) and all employees (any status). An individual who is found to have committed sexual harassment in violation of this policy is subject to the full range of University discipline, up to and including termination of employment or expulsion. The University will provide persons who have experienced sexual harassment with ongoing remedies as reasonably necessary to restore or preserve access to the University's education program and activities.

Inquiries concerning the specific application of Title IX at Ball State should be directed to Ms. Katie Slabaugh, Associate Dean of Students/Title IX Coordinator in the Frank A. Bracken Administration Building, room 238, 765-285-1545, kslabaugh@bsu.edu. Persons can also contact the U.S. Department of Education Office for Civil Rights, Washington, D.C. 20202-1328, 1-800-421-3481, ocr@ed.gov.

Student Academic Ethics Policy

Actions which include but are not limited to cheating, plagiarism, falsely claiming to have completed work, cooperating with another person in academic dishonesty, knowingly destroying or altering another student's work, or attempting to commit an act of academic dishonesty that violates the Student Academic Ethics Policy (<http://www.bsu.edu/associateprovost/academicethics>).

The consequences of academic dishonesty are determined on a case-by-case basis by each instructor and may include but are not limited to one or more of the following academic sanctions: informal meeting, removal from dual credit course, dismissal from the university, or other appropriate consequence.

Syllabus Change Policy

This syllabus is a guide to the course and may be subject to change with reasonable advanced notice as course needs arise.