LOCALLY DEVELOPED COURSE OUTLINE

Astronomy15-3

Submitted By:

Chinook's Edge School Division No. 73

Submitted On:

Jun. 12, 2017

Course Basic Information

Outline Number	Hours	Start Date	End Date	Development Type	Proposal Type	Grades
15-3	75.00	06/13/2017	08/31/2018	Acquired	Authorization	G10 G11 G12

Acknowledgment

Course Description

Students are inundated with space and astronomy in modern media yet many are unaware that the sky is changing constantly above them. In this course, students who have completed Science 10 will learn about the techniques used by astronomers. They will practise those skills of observing and documenting with the various objects visible in the day and night skies. Students will be introduced to the sky and it is hoped that they will someday become amateur astronomers.

Course Prerequisite

Co-requisite or pre-requisite – Science 10

Philosophy

The purpose of Astronomy 15 is to provide extended opportunities for students to deepen their understanding of astronomical principles beyond Science 9. Through an inquiry model, students will analyze, assess, and refine connections between celestial observations and human exploration, creativity, innovation, technological advancements, and innate curiosity. Further, they will contribute to the history of human curiosity pertaining to the sky above by critically examining their perspective within the solar system and universe. Throughout the course, students will enhance their scientific literacy and numeracy through the application of active observation and documentation skills (diagrams, sketches, field notes) of various celestial bodies visible in the day-time and night-time skies.

The Astronomy 15 course enables students to be engaged thinkers and ethical citizens by allowing them to strive for personal excellence in their high school learning journey, enhance scientific literacy and numeracy in astronomy. Further, the combination of classroom and field experiences enables students to solve complex problems and to think critically; apply multiple literacies in reading, writing, and mathematics; and to demonstrate communication skills, and the ability to work cooperatively with others in application of knowledge and skills of the celestial sphere. This course provides additional opportunities for students to develop and refine the learner competencies outlined in the Alberta Education's Inspiring Education document.

Rationale

It is the purpose of this course to emphasize the practice of observational astronomy rather than knowledge base of classroom study. Astronomy 15 prepares students to become successful contributors to Canadian society by providing learning opportunities to explore the immense connections between the history of the knowledge of the stars, human exploration, and technological advancements contributing to our understanding of the planet, solar system, and universe. Students will be guided to enhance their propensity to become ethically engaged citizens through appreciating their place within the solar system and universe; and the interconnectedness of social, economic, and environmental endeavors associated with space exploration.

This course is intended to meet the innate curiosity and needs of students living and working in Alberta, and to enhance appreciation for the connections between human development, i.e. light pollution, and our ability to observe the sky. This course enhances the foundations for students to become connected to their environment, province, and decisions regarding celestial observations, and become the ethically engaged contributors and voters to the very-changing nature of Alberta society.

Learner Outcomes

The intent of this course is to have the students become aware of the sky and to gain experience actively observing it. It is important to schedule this course in the fall as there is more opportunity to observe the sky during this time due to the sunset times.

General Outcomes

1 explore and enhance curiosity and appreciation for the size, scale and vastness of space from the planet Earth, to the solar system, to the universe through application of day-time and night-time observations

2 examine and record first-hand observations of positions and motions of objects in the day-time and night-time skies

3 examine the stellar process of star formation; evaluate and interpret first-hand observations of the sun to its impact on the planet

4 interpret, evaluate and apply technological development's impact on astronomical science to comprehension of the Earth, the solar system, and the universe

Specific Learner Outcomes

1 explore and enhance curiosity and appreciation for the size, scale and vastness of space from the planet Earth, to the solar system, to the universe through application of day-time and night-time observations	**15-3**
1.1 formulate and apply understanding of the "seeing" conditions, and differing atmospheric effects impacting transparency of the sky (i.e. light pollution, inversion, clouds, haze).	X
1.2 design and articulate a 3-dimensional, theoretical scale-model of the solar system	X
1.3 apply comprehension of solar system and sky observations to articulate positions and relative motions of moons, plants, asteroids, comets	X
1.4 interpret planetary and satellite motions (i.e. moon) to knowledge of the solar system as they orbit in the same plane (approximately) and follow elliptical paths through the sky	X
1.5 apply comprehension of planetary and satellite motions to day-time and night-time observations to predict (approximately) when a planet will be in opposition to Earth for optimal observation	X
1.6 interpret tabular data of nearby stars to define a light year and apply to observations to determine distance of nearby stars	X

2 examine and record first-hand observations of positions and motions of objects in the day-time and night-time skies	**15-3**
2.1 develop scientific method and application of the basic terms and skills of amateur astronomers when observing day-time and night-time skies through diagrams, sketches, and field notes	X

2.2 apply physiological basis of sight to implications of night-time observations (why most faint objects appear black and white; skill of averting gaze to see faint objects or details; application of red light to successfully record observations requiring some light)	X
2.3 articulate positions and motions of moons, planets and asteroids based on day-time and night-time observations	X
2.4 analyze and apply movement of celestial bodies to units of time including year, month and day	X
2.5 interpret and apply naked eye night-time sky surveys to stellar brightness	X
2.6 interpret and apply naked eye night-time sky surveys to meridian and zenith	X
2.7 interpret and apply naked eye, sextant, and telescopic sky surveys to local coordinates (altitude and azimuth) and geocentric coordinates (right ascension (time) and declination) for measuring positions of objects in the sky to approximate locations for sunrise, sunset and noon for various dates in the year, and various latitudes on the surface of the Earth	X
2.8 interpret naked eye sky surveys of the night-time sky to construct sky maps (including positions of constellations) and apply to the rotation about Polaris	X
2.9 interpret and apply observations to confirm tilt of Earth's spin axis through hypothesizing how the changing geometry of the spin and the orbit of the Earth changes perspective of the Sun at current latitude of observation	X
2.10 interpret telescopic and binocular observations of Earth's moon through its successive phases to analyze how the geometry of the sun, Earth and moon change as the moon orbits the Earth.	X
2.11 interpret telescopic and binocular observations of Jupiter's moons to articulate the geometry of the moon's orbits about Jupiter (direct application of historic conclusion of Galileo in 1609)	X
2.12 evaluate and articulate planets in the solar system including Venus, Jupiter and Saturn (as applicable) through naked-eye and larger aperture telescopic observations	X

2.13 analyze and interpret major astronomical events (such as eclipses, meteor showers	X

3 examine the stellar process of star formation; evaluate and interpret first-hand observations of the sun to its impact on the planet	**15-3**
3.1 apply use of pinholes or telescopes to project the sun's image, size, location, and any visible sunspots on a piece of paper (thereby appreciating the sun is a star and requires safety when observing solar events)	X
3.2 interpret and apply sun's magnetic field to sunspots to impacts on Earth (solar wind, aurora borealis, satellite failures, disruption to electrical power grids)	X
3.3 apply sundial observation to analemma (equation of time) to correction of solar time to local time to interpretation of Earth's spin axis and relative velocity (speeds up or slows down) as the planet orbits the sun; calculate the time of local noon on a given day including time correction to convert to standard time	X
3.4 interpret daily path of the sun through the sky (cone or plane perpendicular to the spin axis of the Earth (i.e. North) to articulation of equinoxes and solstices (sun traces a path perpendicular to the North axis at equinoxes; from the vernal equinox to the autumnal equinox the sun will be above (i.e. North of) the equinoctial plane; from the autumnal equinox to the vernal equinox the sun will be below the equinoctial plane; on the surface of the Earth observed as the path of the sun through the sky tracing an arc Northward (higher in the sky) in summer and Southward (lower) in the winter	X
3.5 construct and interpret life cycles, classes and compositions of stars (i.e. white dwarfs, brown dwarfs, red dwarfs, red giants, neutron stars, black holes etc.) to classify stars and trace lifespans on the Hertzsprung-Russel Diagram	X
3.6 interpret and identify phases of the stellar process of nuclear star formation based on initial gas cloud, mass influence on final state of the star, force of gravity, circular motion	X

4 interpret, evaluate and apply technological development's impact on astronomical science to comprehension of the Earth, the solar system, and the universe	**15-3**
4.1 interpret nature of astronomical science through application of early astronomers tools including naked eye, sundial and simple refracting telescope (Galileo's telescope)	X
4.2 design, construct, and apply knowledge of simple refracting telescope to focal length	X
4.3 design, construct, and apply knowledge of variety of sundials (vertical, horizontal, spherical, reclining, declining) to geometric method of laying out sundial	X
4.4 apply aperture - regarding stellar brightness, focal length - regarding magnification (qualitatively and quantitatively) to celestial telescopic observations (including Galilean refractor, modern simple refractor, Newtonian reflector, Schmidt-Cassegrain)	X
4.5 apply and evaluate technologies to perform a brief survey of the extra-solar planets	X
4.6 compare and contrast telescopic constellation observation to naked eye constellation observation (add variable of colour to those of position and brightness; and observe and sketch binary stars noting brightness, colour separation and orientation)	X
4.7 interpret colours of stars and spectroscopy to qualitatively describe composition, mass, temperature and velocity	X

Facilities or Equipment

Facility

There are no special facilities or spaces required to teach this course. A standard high school classroom is sufficient for the implementation of this course.

Facilities:

Equipment

There is no additional equipment required to implement this course, beyond that which is normally found in a standard high school classroom. Access to a telescope and /or binoculars is not required, but would be beneficial.

Learning Resources

All resources used to teach Locally Developed Courses are subject to Board of Trus approval and only those resources listed in this outline have been approved by the b motion attached.

Garlick, M.A. (2009). Astronomy: A visual guide. Richmond Hill, ON: Firefly Books

The Royal Astronomical Society of Canada. (2013). Observer's handbook. Gupta, F (published annually).

Dickinson, T. (2014). Nightwatch: A practical guide to viewing the universe. Richmo ON: Firefly Books. (Updated for use through 2025).

Mayall, N.R., & Mayall, M. W. (2000). Sundials: Their construction and use. Mineola Publishing Corporation.

Links to related agencies:

Canadian Space Agency

http://www.space.gc.ca/asc/eng/default.asp

Calgary Royal Astronomical Society

http://calgary.rasc.ca

Calgary Science Centre

http://www.calgaryscience.ca/

Astronomy Education Review

http://aer.noao.edu

Please note: several technological supports are available to fortify observations and comprehension of celestial observations. It is suggested that learning experiences a supplemented with classroom based supports such as computer programs: Stellariu Night (High School version); and applications for mobile devices such as Night Sky (continuous development nature of these products).

Others

Sensitive and Controversial Content

It is expected that all issues and texts that may be controversial or sensitive will be discussed with school administration prior to coverage in class.
Guiding principles for dealing with sensitive and controversial issues are outlined in Chinook's Edge *Policy 2-09 Teaching About Controversial Issues*.

Migration Strategies

Safety Components

All Chinook's Edge health and safety procedures will be followed as per regular classroom instruction, in accordance with Chinook's Edge *Administrative Procedure 4-19 Health & Safety*.
If students are taken off campus, all Chinook's Edge procedures pertaining to planning, parental consent, risk assessment, etc., will be followed in accordance with Chinook's Edge *Administrative Procedure 2-09 Field Trips - Planning & Requirements*.

Migration Strategies

Significant Overlap with Provincial Curriculum

This course touches on spectroscopy covered in more detail in Physics 30. Students will be given only sufficient information to understand that the spectra of stars can be used to discover the kinds of elements in the stars. This course also touches on lenses covered in more detail in Physics 20. Again, students will only be given sufficient information to allow them to construct their own telescopes with a reasonable understanding of what they are doing.

This course is a reauthorization and previously has been found by Alberta Education not to have any significant overlap with existing provincially developed courses.

Assessment

Assessment practices for this course should invite student participation in articulating learning targets and setting criteria for success, in providing evidence of understanding and in developing appropriate grading practices. Assessment and grading practices should also reflect the context of particular student, school and classroom learning needs.

Teachers will set specific criteria and grading practices, with students, as they assess student learning based on the learning outcomes from the course. These criteria form the basis for assessing, grading and reporting student progress. Communicating student progress is an ongoing conversation between the teacher, the student and the parent, throughout the course, with the goal of improving student learning.

The validity of assessment will be enhanced if evidence of student achievement, related to the general and specific outcomes, is gathered over time, and through communication with students as they build understanding, revise misunderstandings and refine approaches to learning. Careful observation of students as they engage in learning tasks and critical examination of the work they produce allows teachers to build out a multi-dimensional picture of student learning.

Valid grading reflects a student's achievement towards the learning outcomes. The reporting of behavior, effort, attendance, neatness, group contribution, initiative etc. is reported separately (Webber, Aitken, Lupart, & Scott, 2009, Guskey, 2006, Reeves, 2004).

To be credible and defensible, assessment information that is used in grading a body of evidence, samples student performance, and is related to specified outcomes, based on professional judgment rather than being based on a calculated mean (average).

Assessment and grading practices should take into consideration the helical nature of

learning - the recursive and increasingly complex skills and knowledge required of students as they demonstrate what they know and can do in relation to each of the specific and general outcomes. As the complexity of learning outcomes increases within each level of the course evidence of a more comprehensive understanding is required.

Where a specific learner outcome spans all levels students are expected to show an increasing level of sophistication and refinement of skills in demonstrating the outcome. Overall, general and specific outcomes can be achieved and assessed concurrently rather than sequentially.

Teachers should adhere to the following assessment standards when determining appropriate assessment and grading practices for this Locally Developed Course.

Assessment practices should reflect the following principles:

• Assessment of student performance is explicitly tied to the learning outcomes of the course

• Students are involved in understanding and articulating learning targets and criteria of success

• Students have opportunities to receive feedback in non-graded and formative learning activities and assignments before submitting assignments or engaging in activities for summative evaluation

• Assessments are purposefully designed in ways that motivate and challenge students, and are respectful of student diversity

• Students are provided choice in how they demonstrate learning

• Assessment data is gathered from a broad range of assessment activities and includes information from student work products and performances, from teacher observations of student learning processes, and from student reflections/student-provided evidence of success

• Assigned grades emphasize the most recent and most consistent evidence of student learning

• Assessment of Citizenship, Personal Development and Character is considered within all learning programs as included within the Calgary Board of Education Board of Trustees' Governance Policies.

References

Guskey, T. R. (May, 2006). Making high school grades meaningful. Phi Delta Kappa International,

87(9), pp. 670-675. Retrieved from http://www.jstor.org/stable/20442125

Reeves, D.B. (Dec 2004). The case against zeros. Phi Delta Kappan 86 (4). Retrieved from

http://schools.esu13.org/bannercounty/Documents/caseagainstzero.pdf

Webber, C.F., Aitken, N. Lupart, J. & Scott, S. (2009). The Alberta student assessment study final report. Edmonton, Canada:

Course Evaluation and Monitoring

The Associate Superintendent, Learning Services, in collaboration with the school Principal, will evaluate and monitor this course to ensure that all requirements (by Alberta Education, by the developing board, and by Chinook's Edge) are met. The school Principal will supervise course implementation at the school level.
Course prerequisites, copyright privileges, and conditions listed by the developing board will be strictly adhered to.

Appendix I

Appendix II

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