Syllabus

ASTRONOMY 4 SEM HRS Fall 2015

AST2002 –0W59 Mo. Tu. We. Th. Web Course

Instructor: Dr. Christos Velissaris

Office: PS 130 **E-mail:** Chris.Velissaris@ucf.edu **Phone (office):** (407)-823-1885

Office Hours: Wednesday 12:30 – 1:30 p.m., Friday 12:30 -1:30 pm or by appointment. We can agree on a time to meet me if you talk to me after class or if you send me an e-mail.

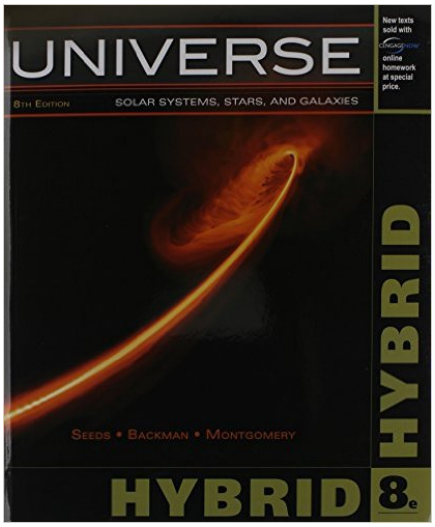
Course Description and Objectives: An introductory study of the night sky, our solar system, its planets with their moons, stars and their lives, brown dwarfs, supernovas, neutron stars, black holes and galaxies. Another name of the course is "The Science of the Cosmos" and it aims to introduce the students to astrophysical notions and processes as well as to the concept of "scientific method" and to critical thinking. This class is NOT an easy one but it can be fun. Prerequisite for this course is High School Algebra or MAC 1105.

The Syllabus and all material related with this class will appear at **WebCourses**. Preliminary, unofficial course information (syllabus, instructions, etc.) will also be available at the website www.physics.ucf.edu/~cvelissaris/Fall15/WWWAST2002 . The website will be frequently updated as the course progresses itself.

This is a rather fast paced course. The content of this course is selected to match nation-wide standards for GED Introductory Astronomy courses. You will work at your own pace and typically you will have to cover three or four chapters a week. You will need to keep studying systematically so that you can keep up with the requirements of the course. Your primary sources of information will be the textbook and your instructor. The syllabus proposes a studying schedule you may find convenient to follow.

It is extremely important NOT to get behind! Once you are behind it may be very difficult to catch up with it again.

Textbook: The required course textbook is:



Universe: Solar Systems, Stars and Galaxies by Michael Seeds, Dana Backman and Michelle Montgomery, 8th Edition, Hybrid Version, Cengage Learning. ISBN-10: 1-285-85388-1
ISBN-13: 978-1-285-85388-8

A "Cengage Now" code is required with the textbook for online Homework submission. The "Hybrid Version" of the textbook is a package that includes the textbook itself plus a Cengage-NOW access code. I believe that the "Hybrid Version" of the textbook is also the cheapest possible (by 50%).

Here are the textbook buying options:

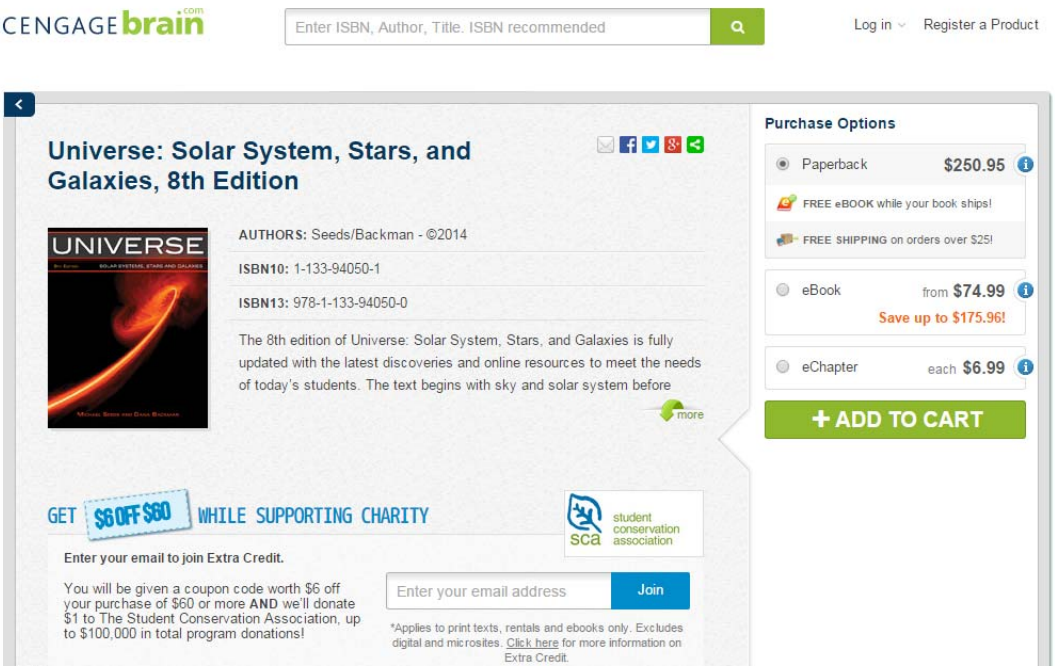
1) The Hybrid Text version can be purchased at the bookstore or online directly from Cengage at the following link:

   http://www.cengagebrain.com/shop/en/US/storefront/US?cmd=CLHeaderSearch&fieldValue=9781285853888

2) Complete text version includes options for ebook or rental can be found for purchase at the bookstore or online at the following Cengage link to purchase:

http://www.cengagebrain.com/shop/en/US/storefront/US;CMGTJSESSIONID=dhh4VtKb8tf6GMh4BjCHlCz2Nv8nxdQSt5y2s7ZvvpnJJbfTjGRg!2107710229?cmd=catProductDetail&entryPoint=storefront&cid=APL1&productID=14546102223036445821096715712223502 57&messageType=catProductDetail&showAddButton=true

However if you decide to rent or buy the book standalone you also have to buy the "Cengage NOW" code for online homework submission separately.



Prerequisites and expectations: If you had high school algebra and you remember it, you are in good shape. Otherwise you must take MAC 1105 or MGF 1106 before this class. You are expected to be able to do elementary algebra calculations. This class is NOT an easy one but it can be fun.

This is a rather fast paced course. The content of this course is selected to match nation-wide standards for GED Introductory Physical courses. You will work at your own pace and typically you will have to cover three or four chapters a week. You will need to keep studying systematically so that you can keep up with the requirements of the course. Your primary sources of information will be the textbook and your instructor. The syllabus proposes a studying schedule you may find convenient to follow.

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Academic Misconduct: Any violation of academic honesty, no matter how small, will be penalized at first occurrence with an F in the course and it will be reported to the Office of Student Conduct.
Please read the information on the page http://integrity.sdes.ucf.edu/zgrade. Depending on the seriousness of the offense, the additional penalties (besides the failing grade) can

be quite severe. Even if it occurs before the drop date, dropping the class will not remove the failing grade from your transcript and the additional penalties cannot be avoided. Therefore you are advised to follow all rules of academic integrity and report any such violations you may observe. Allowing people who behave unethically to get away creates bad reputation for the entire university and therefore diminishes

Although the following list is not exhaustive, it provides some examples of academic dishonesty that will be penalized according to the above rule:

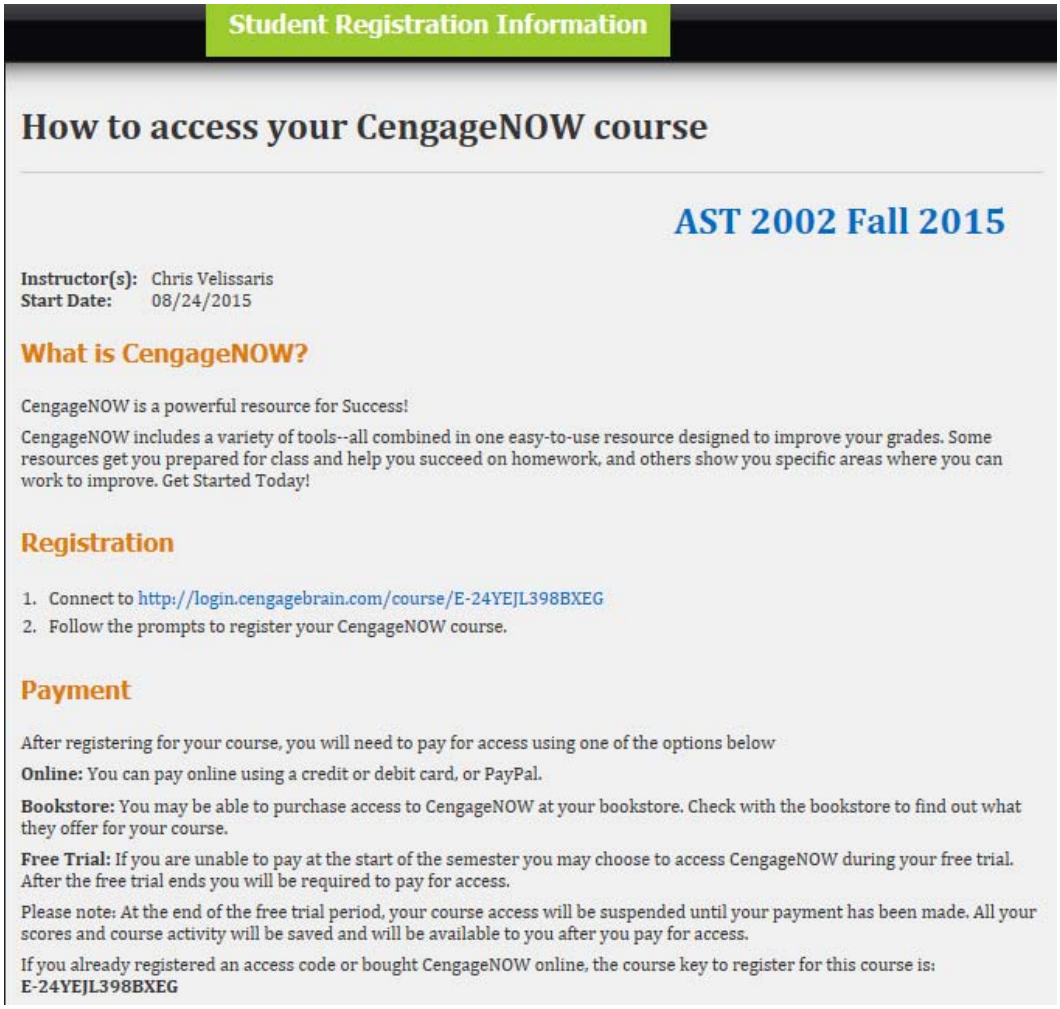
- Cheating in the homework (such as copying from other people, ask other people to do it for you, etc.)
- Cheating in the papers (such as copying from other people, copying from the web, etc.)
- Identity fraud with the clicker (such as using multiple clickers, asking other people to answer questions for you, etc.). Not applicable in this class.
- Cheating during the exams (such as copying from other students, asking for help from other students, using cheat-sheets, ask other students to take the exam for you, etc.)

In addition, other inappropriate behavior that does not involve academic cheating will also be penalized severely although it may not imply an automatic failing grade. Some examples of such behavior is repetitive disruption of the lectures by talking to other students, walking inside the classroom, using your cell phone (even if it is muted), using your laptop to surf the web.

Homework Assignments: There will be Homework Assignments.
The Homework will be submitted electronically via the "Cengage Now" electronic homework submission service. In order to do the Homework you will need to purchase a Cengage Now access code and enroll yourselves electronically to the course.
You can register to the course in the following Course Registration URL:

http://login.cengagebrain.com/course/E-24YEJL398BXEG

Here are some instructions on how to register to our Astronomy Course at the CengageNOW website.



Student Registration Information

How to access your CengageNOW course

AST 2002 Fall 2015

Instructor(s): Chris Velissaris
Start Date: 08/24/2015

What is CengageNOW?

CengageNOW is a powerful resource for Success!

CengageNOW includes a variety of tools--all combined in one easy-to-use resource designed to improve your grades. Some resources get you prepared for class and help you succeed on homework, and others show you specific areas where you can work to improve. Get Started Today!

Registration

1. Connect to http://login.cengagebrain.com/course/E-24YEJL398BXEG
2. Follow the prompts to register your CengageNOW course.

Payment

After registering for your course, you will need to pay for access using one of the options below

Online: You can pay online using a credit or debit card, or PayPal.

Bookstore: You may be able to purchase access to CengageNOW at your bookstore. Check with the bookstore to find out what they offer for your course.

Free Trial: If you are unable to pay at the start of the semester you may choose to access CengageNOW during your free trial. After the free trial ends you will be required to pay for access.

Please note: At the end of the free trial period, your course access will be suspended until your payment has been made. All your scores and course activity will be saved and will be available to you after you pay for access.

If you already registered an access code or bought CengageNOW online, the course key to register for this course is:
E-24YEJL398BXEG

I am also including in the Syllabus the Cengage 1-800 Customer Service Tech Support Number:

Cengage Customer Service/Tech Support: 1- 800-648-7450
www.cengage.com/support

Hardcopy Instructions on how to Register to "CengageNow" can also be found in PDF format along with this syllabus at Webcourses and at:
www.physics.ucf.edu/~cvelissaris/Fall15/WWWAST2002 .

Examinations: There will be four Exams, three mid term and one Final.

You need to take all four exams. If you fail to take one exam you will get a zero to this exam.

Each exam will contribute 20% towards your net class score.

The Exams will be web based consist of a number of simple multiple choice questions. The question will be related to the concepts and ideas related to the class. Some questions requiring very simple algebraic manipulation of numbers **and units** will be present.

Exams will be on these dates:

Exam 1: Sept. 18 Exam 2: Oct. 16 Exam 3: Nov. 13 Exam 4: Dec. 7

The above dates are the exam "official dates". However the exam will usually open one or two days earlier and close one or two dates later than the posted dates. I will make an effort to keep the exam open during the whole weekend to accommodate all possible cases. NO MAKEUP EXAMS WILL BE GIVEN IF YOU FAIL TO TAKE THE EXAM WITHIN THE ALLOCATED TIME PERIOD THE EXAM IS OPEN. If you fail to take the exam on these days you will get a zero on this exam. Once you open the exam you will have a fixed amount of time (depending on the number of questions) for submitting your answers.

Missed Work Policy: Make up or missed work will be permitted for the following reasons: Family emergency, religious observance, University sanctioned activities or bona fide medical emergency. Justifying documentation and a written request must be submitted personally to the instructor in every case.

Grade: Your final score and therefore your letter grade will be the resultant of a number of parameters. Here is a list of what counts for your final score and what is the weight of each component. (100% TOTAL)

- 20% Four Exam scores.
- 20% Average Homework Score.

Your total score will be the weighted average and will be computed therefore as follows:

Total score in the course = 0.20*(First Exam Score) + 0.20*(Second Exam score) + 0.20*(Third Exam Score) + 0.20*(Fourth Exam Score) + 0.20*(Average Homework score submitted at "Cengage NOW")

A standard grading scale will be used to determine your class letter grade from your total score.

Letter Grading Scale:

$100\% \geq A \geq 94\%$ $94\% > A- \geq 88\%$
$88\% > B+ \geq 84\%$ $84\% > B \geq 78\%$ $78\% > B- \geq 74\%$
$74\% > C+ \geq 68\%$ $68\% > C \geq 64\%$ $64\% > C- \geq 58\%$
$58\% > D \geq 50\% > F$

NO GRADE INFORMATION WILL BE GIVEN OVER TELEPHONE OR E-mail.
All examinations will be closed book. Your instructor will provide for you a formula sheet (if applicable) that you will be allowed to use during you exam. In determining your grade at the end of the term:
(1) the Midterm and Final Exam scores will count for everyone, and
(2) the home work will count for everyone.
(3) +/- grades will be given.
If you miss one (or more) exams, you will receive a score of zero on the exam(s).

Feedback: Feel free to give us any kind of feedback on the course. We value your comments and they do influence our ideas. If we do not implement them, often it is because there are too many other constraints to be taken into account that tie our hands. However, we are always glad to hear from you. Send comments to the following email address: Chris.Velissaris@ucf.edu

Disclaimer: The instructor reserves the right to make changes to the syllabus as necessary. Any changes will be in effect only one week after announced to the students.

Course Objectives: Students who take the GED AST2002 Course at the end of the course will know:

From Chapter 1 Students should know:

1) Know our cosmic address in the Universe.
2) Have an idea about cosmic scales and distances in the Universe.
3) Have an idea about the timescale in the universe and when in life on earth and time human civilization fits.

From Chapter 2 Students should know:

1) What are Asterisms, Constellations and Stars.
2) How Stars are being classified according to their brightness. What is magnitude scale and apparent visual magnitude.
3) What is the "Celestial Sphere".
4) What is the phenomenon of "precession" and how it is related to Astronomy.

From Chapter 3 Students should know:

1) What is called "ecliptic" and what "ecliptic plane".
2) How the Sun and the stars appear to move in the sky due to Earth's rotation about its axis.
3) How the Sun appears to move in the sky relative to the Stars due to the Earth's revolution around the Sun.
4) What is the effect of the Earth's axis tilt with respect to the ecliptic plane and how the Seasons are formed.
5) How the planets appear to move in the sky due to the Earth's rotation about its axis.
6) How the planets appear to move in the sky relative to the stars due to the Earth's revolution around the Sun.
7) Why in ancient times the planets were called "wanderers".
8) How is the moon moving in the sky with respect to the Sun and the other stars.
9) What are the phases of the moon, how are they being formed.
10) What is a lunar eclipse, how and when it is being caused.
11) Why we do not have a lunar eclipse every time the Sun and moon are opposite.

12) What is a solar eclipse, how and when it is being caused.
13) Why we do not have a solar eclipse every time the Sun and moon are opposite.

From Chapter 4 Students should know:

1) Know the ancient views of Astronomy and the Universe.
2) Know the Aristotelian view of Astronomy and the Cosmos.
3) Know the astronomy according to Ptolemy and about his idea of epicycles.
4) Know about the Copernican view of Astronomy and the Copernican Revolution.
5) Know about Tycho Brahe's contribution and work in Astronomy as well as the ideas of Kepler.
6) Know the three laws of Kepler regarding the planetary motion.
7) Know about the work and contributions of Galileo Galilei in Science Astronomy.
8) Know about Isaac Newton work and his three laws of motion.
9) Know how the tides are being caused and the difference between "spring" and "neap" tides.

From Chapter 5 Students should know:

1) Know the nature of light and electromagnetic radiation.
2) Know the concepts of wavelength and frequency.
3) Know the concept of the "photon".
4) Know what is the "electromagnetic spectrum" and the properties of light depending on its wavelength and its position in the electromagnetic spectrum.
5) Know how a telescope works and the differences between reflecting and refracting telescopes.
6) Know the various types of telescopes (radio telescopes, X-Ray telescopes, etc) that modern astronomy is using and why astronomers are using such a variety of telescopes.
7) Know what are CCDs and why they are more preferable that old type photographic plates and films.
8) Know what is Adaptive Optics.
9) Know what is Interferometry.

From Chapter 6 Students should know:

1) Know what is an "Atom" and describe a model of it along with the various "parts" of the atom.
2) Know what is an "isotope", an "ion" and a "molecule".
3) Know what is a Coulomb force and what is an electron's "binding energy".
4) Know how "quantum mechanics" describes the "atom" and what are the "permitted orbits" of the electrons.
5) Know how the atom becomes "excited and how the electrons of the atom absorb and emit light (em radiation) by jumping between various allowable orbits.
6) Know why an atom can absorb and emit only specific radiation (wavelengths) pertinent to the "energy levels" (allowable orbits) of its electrons.
7) Know what is Thermal Energy, Heat and Temperature.
8) Know what is blackbody radiation, wavelength of maximum intensity and to interpret the graph of blackbody radiation intensity vs wavelength.
9) Know the law of Stefan-Boltzmann and the law of Wien for blackbodies.
10) Know the three types of Atomic Spectra and what kind of bodies emit each spectrum type.
11) Know the Doppler effect with light and what are the phenomenaof blueshift and redshift.

From Chapter 7 Students should know:

1) Know the three layers of the atmosphere of the Sun.
2) Describe the Photosphere of the Sun and the phenomena on it.
3) Know what are the "sunspots", the phenomenon of "granulation" and what are supergranules.
4) Know what is the phenomenon of "convection" and how it applies to the sun.
5) Describe the Chromosphere of the Sun and the phenomena on it.

6) Describe the Solar Corona and the phenomena on it.
7) Describe the Sun's magnetic cycle and how the magnetic dynamo effect and the Sun's differential rotation affect it.
8) Know the "Solar Constant" and how it might have affected the Earth's average Temperature.
9) Know what is "fusion" and how the Sun produces Energy via Nuclear Fusion.
10) Know how the Energy the Sun is produced at its center is being transported to its surface and from there to the outer space.

From Chapter 8 Students should know:

1) Know how and where the atoms in our body and Earth were created.
2) Know how the Solar Nebula Theory models the creation of our Solar System.
3) Know the difference between the Jovian and Terrestrial planets in our Solar System..
4) Know and describe the various types of cosmic debri in our solar system, asteroids, comets, meteors, meteoroids, meteorites and Kuiper Belt Objects.
5) Know the age of our solar system and how it is being measured.
6) Describe the story of the creation of our planetary system.
7) Know the chemical composition of the solar nebula that built the solar system
8) Know what is "condensation" and how the condensation of solids was made in our solar system from the Solar Nebula.
9) Know what is the process of "accretion" and how the "planetesimals" were formed.
10) Know how the "protoplanets" were formed from the planetesimals and how gravitational collapse evolved the protoplanets into planets.
11) Know what is called "differentiation" in astronomy and how this process has affected the structure ot the planets.
12) Know what is referred as the "Jovian problem"
13) Know the general characteristics of extrasolar planets (planets in other star systems) and how astronomers are detecting them.

From Chapter 9 Students should know:

1) Know the four stages of planetary development.
2) Know the three layers of the Earth.
3) Know how astronomers and geologists are probing the Earth's interior
4) Know what is plate Tectonics and how it affects the outer layer of the Earth (crust).
5) Describe the Earth's atmosphere.
6) Know what is the greenhouse effect, how it is created by the atmosphere and how it affects Earth's climate.
7) Know what is called albedo of the planet.
8) Describe the surface of the moon and its two types of terrain lunar lowlands (maria) and lunar highlands.
9) Know the origin and history of earth's Moon as well as the large-impact hypothesis for the Moon creation.

From Chapter 10 Students should:

1) Know the history, composition, surface and general properties of Mercury.
2) Know the history, composition surface, atmosphere and properties of Venus.
3) Know the history, composition surface, atmosphere and properties of Mars.

From Chapter 11 Students should know:

1) Know the history, composition surface, atmosphere and properties of Jupiter.
2) Know what is "metallic hydrogen" how it is being formed and how it affects Jupiter's magnetic field.
3) Know the general properties of Jupiter's moons.
4) Know what is "tidal heating" and how it affects Jupiter's moon Io.

5) Know what are the implications of Europa's (another Jupiter moon) ocean.
6) Know how Jupiter's rings were formed and what is their structure.
7) Know the history, composition surface, atmosphere and properties of Saturn.
8) Know the general properties of Saturn's moons.
9) Know how Saturn's rings were formed and what is their structure.
10) Know the history, composition surface, atmosphere and properties of Uranus.
11) Know the general properties of Uranus's moons and rings.
12) Know the history, composition surface, atmosphere and properties of Neptune.
13) Know the general properties of Neptune's moons and rings.
14) Know the history, composition surface, atmosphere and properties of Pluto as well as its relationship with the Kuiper belt.

From Chapter 12 students should:

1) Know what meteoroids, meteors and meteorites are and how they differ with each other.
2) Know the composition and the three types of meteorites.
3) Know the composition, origin and orbits of the meteoroids.
4) Know the origin, composition and history of asteroids.
5) Know the origin, history composition and geology of the Comets.
6) Know what is the Oort Cloud and the Kuiper Belt.
7) Know the consequences of asteroid and comet impact with earth and how such events in the past have changed the history of our planet.

From Chapter 13 students should:

1) Know the meaning of Star Parallax.
2) Know how astronomers determine the distance of a Star from the Earth from its measured "Parallax".
3) Know what is the "parsec".
4) Know what is Energy "Flux"
5) Know how the brightness of a star depends on its distance from the Earth.
6) Know the difference between the apparent visual magnitude and absolute visual magnitude of a Star.
7) Know how astronomers correct the apparent visual magnitude of the star for the star distance.
8) Know what is the "Luminosity" of a star.
9) Know what is the Balmer Thermometer and how it tells us the temperature of a star.
10) Know what is the Temperature Spectral classification of the Stars and the various "spectral classes" of stars.
11) Know the Hertzsprung – Russell (HR) diagram and how the stars are being classified according to their position on that diagram (main Sequence, White dwarfs, Red dwarfs, Giants, Super giants etc).
12) Know what is the Luminosity Spectral Classification of the Stars and the various classes of stars according to this type of classification.
13) Know what is the "spectroscopic parallax" method to determine the distance of stars.
14) Know what are the "Binary Stars"
15) Know what is the difference between visual binary and spectroscopic binary stars.
16) Know what pair of binary stars is called eclipsing binary.

From Chapter 14 students should:

1) Know what do we call Interstellar Medium and how it is observed.
2) Know the three types of nebulae and their differences.
3) Know how star birth start in molecular clouds and how protostars are then formed.
4) Know what is the Orion Nebula and how it provides evidence of Star formation.
5) Know how stars are being born and what are their life stages until they enter the main sequence at the H-R diagram.
6) Know what competing processes are keeping a star stable.
7) Know what is dark matter.

8) Know how astronomers know the presence of dark matter in Galaxies.
9) Know how the energy is produced at the core of the star and how it is transported to its surface and to space.
10) Know what is the "Pressure – Temperature" Thermostat.
11) Know what is the CNO cycle.
12) Know how the Luminosity, Mass and Lifetime of a main sequence star are related.
13) Be able to describe the life stages of a star at the main sequence of an H-R diagram.

From Chapter 15 students should:

1) Know which stars in the main sequence will become giants.
2) Know what will happen when the star uses up all hydrogen in its core.
3) Know what is degenerate matter, its properties and its importance for the main sequence stars.
4) What is Hydrogen fusion, Helium fusion and Helium Flash.
5) Know how the stars in the main sequence will die.
6) Know what are red dwarfs and which stars in the main sequence will become red dwarfs.
7) Know the fate and death of our Sun.
8) Know what sre white dwarfs and which stars become white dwarfs.
9) Know hoe mass transfers between binary stars and what are the Roche Lobes.
10) Know what are the Lagrange points of a binary Star system.
11) Know how a binary star system will evolve if there is mass transfer between its members.
12) Know what is a novae and a novae explosion.
13) Know how supermassive stars are living and dying.
14) Know what is a supernovae and how these stars are classified.

From Chapter 16 students should:

1) Know what is a neutron star and how theory predicts its existence.
2) Know what is a pulser, how it was discovered and how it is related with a neutron star.
3) Know what is a black hole and how it is formed.
4) Know the properties of a black hole.
5) Know how jets are emitted from compact objects.
6) Know what are Gamma Ray Bursts.

From Chapter 17 students should:

1) Know what is the "Milky Way" and how have we determined that we are in a Galaxy.
2) Know what are Cepheid stars and why they are important.
3) Know and describe the components, structure and shape of our Galaxy,
4) Know what is at the center of our Galaxy.
5) Know and explain how our Galaxy was formed , its history and its age.
6) Know the importance and difference between Population I and Population II stars.

From Chapter 18 students should:

1) Know the three different types and subtypes of Galaxies as well as how Galaxies are classified into these types and subtypes.
2) Know what is a standard candle and why it is important.
3) Know what do Astronomers mean by "Distance Indicators" and how they are being used to determine the distance to a Galaxy.
4) Know how astronomers calculate the diameter of a Galaxy from its distance.
5) Know how astronomers calculate the luminosity of a Galaxy from its distance.
6) Know what is the rotation curve method and how it is used to measure the mass of the Galaxy.
7) Know what is the Hubble constant and the Hubble Law.

8) Know what klies at the center of galaxies and how astronomers determine it.
9) Know what is the phenomenon of Gravitational Lensing and how it is used to detect the presence of dark matter.
10) Know what is the "Local Group" of Galaxies.
11) Know what are Active Galactic Nuclei (AGN).
12) Know the properties of Seyfert Galaxies.
13) Know what are the Double-Lobed Radio Sources.
14) Know what are Quasars and what are their properties.

From Chapter 19 students should:

1) Describe the observable Universe and the expansion of the Universe.
2) Know how old is the Universe and how we know it.
3) Explain the Big Bang Theory.
4) Know what is the Cosmic Microwave Background (CMB) and how cold it is.
5) Know how the Universe evolved during the first minutes after its creation.
6) Explain the Cosmological Principle.
7) Explain what is Dark Matter.
8) Explain what is inflation and how it had affected the evolution of our Universe.
9) Explain what are: flatness, horizon and large scale structures in the Universe.
10) Name the possible fates of the Universe and which one is most likely according to our current knowledge.

From Chapter 20 students should:

1) Know the physical bases of life.
2) Know what is DNA and its importance for Life.
3) Know what is the oldest life on Earth and how it appeared.
4) Know how life originated on Earth.
5) Know two ingredients that could render a planet habitable.
6) Determine how many worlds could be habitable.

Course Schedule: A tentative course schedule is given with this syllabus. The instructor reserves the right to make any changes as necessary.

Date	You will cover	Book Chapters
Week 1 August 24 – 28	Our Cosmic address. Cosmic and time scales in our Universe. Modern View and scale of the Universe. Our position in the Universe. "Star Stuff" and our cosmic origin. The Celestial sphere and constellations. Ecliptic and the Zodiac. The night sky. Motion of the stars. Daily and annual motion. Motion of the Sun, the Moon and the Planets. The seasons. The moon and eclipses.	Ch # 1 - 3
Week 2 August 31 – September 4	Ancient Astronomical Theories. The Copernican Revolution. Heliocentric and Geocentric theories. The laws of Kepler. Motion and Newton's Laws of Motion. The force of Gravity. Conservation Laws in Astronomy.	Ch # 4
Week 3 September 7 – 11	Properties of light and matter. How we learn from Light. Telescopes.	Ch # 5
Week 4 September 14 – 18	Atoms, interaction of light and matter. Blackbody radiation. Emission and absorption of light Spectra.	Ch # 6
September 18	**EXAM 1**	**Ch # 1 - 6**
Week 5 September 21 - 25	The Sun and its properties. The atmosphere of the Sun. Nuclear fusion in the Sun. Sun Earth relationship. Sun Weather and its effect on Earth. The Jovian Planets. Jupiter, Saturn, Uranus, Neptune. The Moons of Jupiter and Saturn. Asteroids, Meteorites, Comets and their properties.	Ch # 7 - 8
Week 6 September 28 – October 2	Formation of our solar system and birth of planets. The Terrestrial and the Jovian Planets. The Solar Nebula theory. The Earth and its Moon. Geology and properties. Mercury, Mars and Venus.	Ch # 8 - 9
Week 7 October 5 - 9	The Terrestrial planets Mercury Venus and Mars. History, Geology and properties. The Jovian planets and the outer solar system. Jupiter, Saturn, Uranus, Neptune and Pluto.	Ch # 10 -11
Week 8 October 12 -16	Solar system debri. Meteorites, asteroids and Comets. Composition, origin history and properties.	Ch # 11-12
October 16	**EXAM 2**	**Ch # 7 - 12**
Week 9 October 19 - 23	Stars and properties of Stars. Star Clusters. The birth and the death of Stars. Brown dwarfs. The live of high and low mass Stars. Star remnants. White Dwarfs, Neutron Stars, Black holes and their properties. X Ray and Gamma Ray bursts.	Ch # 13
Week 10 October 26 – 30	The Interstellar medium and formation of Stars. Stellar structure and Nuclear Fusion. The CNO cycle. The main sequence stars.	Ch # 14
Week 11 November 2 - 6	Giant Stars and the type of stars will become giants. The life and the death of Main Sequence stars. The death of Massive Stars. The evolution and life of Binary Systems.	Ch # 15
Week 12 November 9 – 13	The cosmic Graveyard. Neutron Stars. Black Holes. Compact Objects with Disks and Jets.	Ch # 16

November 13	**EXAM 3**	**Ch. # 13 - 16**
Week 13 November 16 – 20	Our Galaxy the Milky Way. Properties and History of the Milky Way. Galactic Recycling. The Black Hole at the center of our Galaxy. Classification and properties of Galaxies. The evolution and interaction of Galaxies. Active Galactic Nuclei. Supermassive Black Holes at the center of galaxies.	Ch # 17 – 18
Week 14 & 15 Nov. 23 – 25 Nov. 30 – Dec. 4	History of the Universe and the Big Bang Theory. The Cosmic Microwave Background Radiation and its properties. The Cosmological Principle and space time. Dark Matter and Dark Energy. Inflation and the fate of the Universe. The Nature of Life. DNA and its importance. Life on Earth and in the Universe.	Ch # 18 – 19 Ch. # 20
Monday **December 7, 2015**	**EXAM 4**	***Cumulative***