# ASTRONOMY 320 SYLLABUS

# **ASTRONOMY 320** University of Arizona

# Philosophy and History of Astronomical Thought

**PROF. MICHAEL CHRISS** Fali 2016

TEXTS:

(required)

Hoskin: The Cambridge Illustrated History of Astronomy, Cambridge Univ. Press

This book is out of print but many copies are available on Amazon and Barnes & Noble.

There is a copy reserved for this class in the SO Library, on the 3<sup>rd</sup> floor of the Steward Observatory.

(required)

Chriss: Handbook for ASTR 320 (find this in the D2L site for this course. Free -of course!)

(required)

STELLARIUM (this is a computer program that you can download for free)

(optional)

North: Cosmos, Univ. Chicago Press, 2008

North's book is a brand new compendium of information, a brick of a book, encyclopedic in scope.

CLASS MEETINGS: Lectures will be given TTh 2:00-3:15p in room SO 204.

**OFFICE HOURS:** 

Tuesday and Thursday, before or following class, or by arrangement. Office: N402

ATTENDANCE AND ETIQUETTE: Class attendance is important and mandatory. Academic integrity and behavior is required and expected. (see further attendance and etiquette information in Astr320 Handbook/ Sec.1d.)

IMPORTANT DATES: 1<sup>ST</sup> Lecture- Aug. 23<sup>rd</sup> Thanksgiving Break- Nov. 24-27

Last Lecture- Dec. 6th

Final Exam- Dec.13 (3:30p)

**ATTENDANCE** Class attendance is very important. My lectures make up the heart of the class and exams will be based on the classroom topics covered. To achieve a good grade in this class you must attend all lectures and take good notes. Attendance will be taken routinely and will be counted in determining your final grade as follows:

- . 1 to 3 absences no grade penalty
- . 4 to 7 absences one letter grade lower for semester
- . more than 7 absences student dropped with a "W" or "E"

[Excess absences made be made up by writing essays from the PREP GUIDES (Sec.6b). See Handbook, Sec 8 and Sec. 6b]

#### GRADING

**EXAMINATIONS** 

- 1. 2 midterms and 1 final exam -(multiple-choice, key terms, brief essays), as indicated in the lecture schedule.
- Students who wish a semester grade of "A" are also required to do additional work (\*see below).

There will be 2 midterms + 1 final as indicated in the lecture schedule. Each exam will cover only those lectures which are indicated there:

Exam #1: Lectures 1-9

Exam #2: Lectures 10-16

Exam #3 (final): Lectures 17-27 + previous

The exams will consist of questions originally chosen from the Handbook, EXAM STUDY GUIDES (Sec. 6a). I will update these study guides questions prior to eac exam to eliminate items that will not be on the exam. You will find these updates in the Handbook, EXAM PREP GUIDES (Sec. 6b).

**GRADING:** 

A = 88%; B = 78%; C = 63%; D = 48%

<minimum % scores

[A missed exam will receive a grade of 0. If you miss an exam see me and read Handbook, Sec.8-Grade Improvement Form]

#### \*ADDITIONAL WORK REQUIREMENT FOR "A" GRADE

(1) answer additional essay questions on the final exam

There will be additional essay questions on the final exam for "A" students to answer.

(2) write 9 essays from Prep Guides (Sec.6b) -due on date of final exam.

Hand in 9 essay questions of your choice from Exam #1-3 Prep Guides, with a minimum of 2 essays from each Exam Prep Guide. These 9 essays must be at least one <u>fully</u> page per essay, and must be <u>fully</u> and <u>accurately</u> answered.

## **COURSE OUTLINE AND TENTATIVE LECTURES (SEC. 1b)**

The tentative lecture schedule for the semester, along with readings for each lecture.

[see Section 1b in this Handbook for details.]

#### **LECTURE OUTLINES SEC. 1c)**

Every lecture given in class is outlined in detail.

[see Section 1c in this Handbook for details.]

# **HOMEWORKS and READINGS SCHEDULE** (SEC. 1d)

Homework questions and Text/Handbook readings.

[see Section 1d in this Handbook for details.]

## STUDY GUIDE and PREP GUIDE QUESTIONS

(Astronomy 320 Handbook, Sec. 6a, 6b + 6c, 6d)

1. EXAM STUDY GUIDES The study questions from which the exam prep guides are made up.

2. EXAM PREP GUIDES A preview of the questions from which the exams are made up.

[see Handbook/Sec. 6a for full details] [see Handbook/Sec. 6b for full details]

3. OTHER HOMEWORK PROBLEMS Additional study problems as assigned.

[see Handbook/Sec. 6c for full details]

4. EXTRA CREDIT ASSIGNMENTS Extra credit activities to improve your semester exam grades

[see Handbook/Sec. 6d for full details]

Exam Study Guide questions are found in the Handbook, Sec.6a; Exam Prep Guide questions are found in Handbook, Sec.6b. These questions are designed to aid in your learning of the material of this course and to help you to prepare for the exams.

HOMEWORK SCHEDULE: Study Guide Questions to prepare and be discussed at our next lecture session [see Handbook, Sec.6a]

- (1) At The End Of Each Week: do that part of the Study Guide questions which relate to the class lecture material of that week.
- (2) Prior To Each Exam: you should review the Prep Guide questions for that exam.
- (3) In Addition: read Handbook/Sec.4-Readings which go with each lecture, as marked.

### **DOING WELL IN THIS CLASS:**

- 1. COME TO CLASS ... EVERYTIME.
- 2. TAKE GOOD LECTURE NOTES IN CLASS ... ON EVERYTHING! <WRITE IT ALL DOWN FULLY, COMPLETELY, ACCURATELY
- 3. COMPLETE THE STUDY GUIDES FOR EACH LECTURE ... AFTER EACH LECTURE.
- 4. COMPLETE THE PREP GUIDE FOR EACH EXAM ... (well) BEFORE EACH EXAM.
- 5. READ IN THE READINGS (SEC.4) THAT GO WITH THE LECTURES ... AFTER EACH LECTURE.

University of Arizona

# The Philosophy and History of Astronomical Thought

PROF. MICHAEL CHRISS

Fall 2016

Lectures 17-27 + previous (given during the Final Exam period.

	Lecture Dates Approximate LECTURE	SCH	Lecture Dates Approximate	
Aug. 23 25	PREHISTORY: THE ROOTS OF ASTRONOMY (prior to 500 BC)  Theme: The Cosmic Quest- the search to find our meaning in the universe begins with the search to find our place in the universe.  L 1 "CLOSED WORLD TO INFINITE UNIVERSE"      course introduction and overview  L 2 "WHAT IS TRUTH?" – the philosophical foundations of the scientific view  THEME #1	11 13 18	L 14 "THE CRIME OF GALILEO" - Galileo, the Pope, and the battle for men's minds. L 15 "THE MARRIAGE OF HEAVEN AND EARTH" - Newton and the physics of the universe L 16 "THE CLOCKWORK UNIVERSE" – fate, free will, and the clockwork universe	
30 1	THE SKY ABOVE AND THE EARTH BELOW  Theme: The starry vault of night becomes the inspiration of ancient culture's religion L 3 "THE BOWL OF NIGHT" - motions in the sky L 4 "SKYWATCHERS OF THE ANCIENT WORLD" - archeoastronomy: Egypt to  Medicine Whee	20	●●THE POST-NEWTONIAN AGE: THE GROWTH OF THE SCIENTIFIC WORLD VIEW (1700 to 1900 AD)  Theme: The scientific method takes form and transforms the world view. The Enlightenment.  L 17 "SCIENTISTS, ARTISTS, REVOLUTIONS - science societies, art, politics	
6	OCHAOS TO COSMOS: GREEKS, ROMANS, CHRISTIANS, MOSLEMS: THE FOUNTAINHEAD (500 BC to 1000 AD)  Theme: The philosophers of classical Greece find a geometrical logic and design to the structure of the heavens, and man's place in it.  L 5 "THE MUSIC OF THE SPHERES" - early Greek astronomy Ionia to	27	Exam   Exam   Lectures 10-16	
8	Pythagoreans L 6 "THE LOGIC OF THE HEAVENS" - the Socratic philosophers  THE COSMIC GEOMETRY Theme: Later Greek philosophers perfect the geocentric model of the universe, an	Nov. 1	UNIVERSE (1700 to 1900 AD)  EXPANDING HORIZONS AND THE PLACE OF MAN  Theme: 18th and 19th century astronomers sweep the skies and discover new worlds around the sun and others suns that form our galaxy; the Milky Way.	
13 15	Greek art and architecture embodies this grand cosmic design.  L 7 "WHEELS ON WHEELS" - the Hellenistic astronomers  L 8 "IDEALS AND PERFECTION" - the Greek ideal of a cosmic art and architecture  MICROCOSM AND MACROCOSM  Theme: The Greek cosmic model forms the basis for Roman Empire society models and the state of the cosmic model forms the basis for Roman Empire society models.	3 8 10	L 18 "THE MEASURE OF THE EARTH" - the voyages of discovery; the longitude prob. L 19 "THE FAMILY OF THE SUN" - the discovery of the solar system: Vulcan to Mars L 20 "THE FAMILY OF THE SUN" - the discovery of the solar system: Uranus to Pluto	
20	and is adapted by the Christians as God's divine plan.  L 9 "EMPEROR,GOD,AND COSMOS" – Romans, Christians, Moslems & cosmology    Exam   EXAM #1 Lectures 1-9	15	L 21 "THE COSMIC PINWHEEL" - the discovery of our galaxy, from Herschel to Shapley L 22 "THE COSMIC PINWHEEL" - the discovery of our galaxy, from to Shapley to Baade  OTHE 20th CENTURY: BRAVE NEW MAN IN A BRAVE NEW	
27 29	● THE REBIRTH OF THINKING: THE RENAISSANCE; NEW HORIZONS FOR MAN (1200 to 1500 AD)  Theme: The paradigm shifts. The Renaissance brings new horizons and new viewpoints for man, on earth and in heaven. The old world ends; a new world begins.  L 10 "NEW VIEWS OF HEAVEN AND EARTH" - the visions of Luther and Columbu L11 "THE NEW PERSPECTIVE" - Renaissance Art and Humanism  ● THE SCIENTIFIC REVOLUTION: THE SHATTERING OF THE CRYSTAL SPHERES (1500 to 1700 AD)	17 22 29	UNIVERSE (1900 to 2000 AD)  WORLDS WITHOUT END  Theme: In the 20th century the astronomers discover an endless universe of galaxies, explore the life of the stars and question whether we are alone.  L 23 "HUBBLE'S UNIVERSE"—The great telescopes, Hubble and the discovery of the galaxies  L 24 "THE GREAT DEBATE & THE SEARCH FOR THE YEAR 0"—superclusters and Ho  L 25 "A JOURNEY TO OZ" • stellar evolution and the search for life in the universe	
Oct. 4 6	THE BIRTH OF A NEW WORLD VIEW  Theme: A new model of the universe takes shape as Copernicus removes the earl from the center and Kepler discovers the mathematics of planetary motion.  L 12 "THE EARTH MOVES!" - Copernicus and a new model of the universe L 13 "A MATHEMATICAL UNIVERSE" - Brahe, Kepler; the mathematics of the cosmos  THE CLASH OF SCIENCE AND RELIGION	Dec.1 6	MODERN MAN AND THE SEARCH FOR MEANING Theme: As the 20th century ends, astronomy, philosophy and theology appear to be asking the same kinds of questions.  L 26 "EINSTEIN AND RELATIVITY - 4 dimensions and the shape of space L 27 "MAN, GODS, MEANING" — lost in the stars: flat earth to noösphere	

Dec13

3:30p

Exam#3:

Theme: Galileo observes the heavens with a telescope and finds new evidence for the

Copernican Theory. He tried by the Inquisition for heresy. The science scene shifts

England, where Newton unites the physics of heaven and earth.

# Astr 320 HOMEWORK and READING SCHEDULE Fall 2016

#### **COURSE OUTLINE AND LECTURES**

This course has been divided into 5 themes, each theme covering one general topic and one historical time period. During each of these periods we will discuss the view of the universe of people living in that period, and how they came to believe in that view. Finally, we will discuss the effect that view had on their lives and their times. [see Astr320 Handbook/Sec.1b-Lecture Schedule for full details]

THEME #1:

SCIENTIFIC TRUTH:

[Weeks 1-2; Lectures 1-4]

What does the sky look like? What is our place in it? How do we know what to believe?

THEME #2:

THE OLD VIEW:

[Weeks 3-5; Lectures 5-9]

Astronomy and society-Greeks, Romans, Christians, Moslems

THEME #3:

THE NEW VIEW:

[Weeks 6-9; Lectures 10-16]

The Scientific Revolution from Copernicus to Enlightenment

THEME #4:

THE MODERN VIEW:

[Weeks 10-14; Lectures 17-25]

Astronomy from Newton to Hubble

THEME #5:

LINGERING QUESTIONS:

[Weeks 15-16; Lectures 26-27]

Life, Religion, God, Meaning

# Astr 320 HOMEWORK and READING SCHEDULE

	LEC No.	HOMEWORK QUESTIONS due this LECTURE (M.Choice - Sec 6a)	OTHER QUESTIONS	READINGS IN HANDBOOK- (Sec.4)	READINGS IN TEXT - (Hoskin) Cambridge Illustrated History of Astronmy
THEME #1:	1	(Milenoice Bee day		1.1 - 1.8	
I LEINIE HT.	2	1-1, Brief Bio		2.1 - 2.4	
SCIENTIFIC	3	2 2,5110.275	<del></del> -	3.1 – 3.2	pp. 2-21
TRUTH	4	3-3	Sec.6c-1/Sec.10 Stellarium Q's	4	22-29
THEME #2:	5	4-12		5.1 - 5.2	29-36
	6	5-16			
THE OLD VIEW-	7	6-18			37-47
Greeks to Moslems	8	7-21	<u> </u>	8	
	9	8-27, 9-32		9.1 - 9.2	50-67
THEME #3:	10	10-2		10.1 - 10.3	68-90
	11	10-5		11	1
THE NEW VIEW-	12	11-6			90-97
Scientific Revolution	13	12-8; 12-16		13	98-121
	14	13-24		14.1 – 14.2	122-143
	15	14-29			144-175
	16	15-35		16.1 – 16.3	
THEME #4:	17	17-2	<u> </u>	17	
	18	17-4		18.1 – 18.2	175-183
THE MODERN VIEW	19	18-5			184-197
Newton to 20 <sup>th</sup> C.	20	19-8			
	21	19-9		21	198-244
	22	21-11			
	23	21-16			244-343
	24	23-18			
	25	23-19		25.1 – 25.8	271-329
THEME #5:	26	25-22		26.1 – 26.4	344-365
LINGERING QUESTIONS	27	27-36		27.1 – 27.6	

-22