Faculty of Science YORK UNIVERSITÉ UNIVERSITY

Division of Natural Science

http://natsci.info.yorku.ca/

Course Outline

SC/NATS 1795.06A Physics of Time & Timekeeping
F/W 2018-19
Thursday 4:00-7:00, CLH D

Course Instructor(s) and Contact Information

Professor: Dr. Robin Kingsburgh
Preferred Contact: Please use moodle for correspondence with Professor
Email: robin@yorku.ca

- Include **'NATS 1795'** in the subject line(otherwise a response will not be sent)
- **Use your full name, including student number, in all correspondence**
- Replies generally returned within 48 hours

Office: 217B Bethune
Office hours: Thursdays 2:30-3:30pm and by appointment (please email)
Webpage: all course content managed on moodle
Term Dates: Sept 6 2018- Mar 29 2019
Drop Date: Feb 8 2019

Course Description

The concept of time has intrigued thinkers from all ages. The impact of measuring and marking time intervals on the development of human culture, and our understanding of the world around us, cannot be understated. The drive to measure and understand time led ancient peoples to a very sophisticated knowledge of the sky; from that knowledge emerged accurate calendars, as well as mathematics itself. We will look at how changing concepts of time and the technological accuracy of measuring time drove fundamental changes in physics, and deepened our understanding of the world around us. This course examines the history of physics through the lens of time. The first half of the course covers timekeeping methods, including the sky as a clock, mechanical clocks, and quartz and atomic clocks. The second half of the course focuses on modern issues of time including time perception, Einstein's revolutionary discoveries on the relative nature of time, and cosmic time.
NCR Note: This course is not open to any student who has passed or is taking SC/PHYS 1010 6.00, SC/PHYS 1410 6.00 or SC/PHYS 1420 6.00.

Course Learning Outcomes

Upon successful completion of this course students should be able to:

- describe how the periodic nature of celestial phenomena were used to mark time by ancient cultures
- observe periodic motions of objects in the sky and describe why they occur
- create a timekeeping device which measures periodic phenomena or durations of time
- recognize how new technological advances in the measuring accuracy of time have impacted and driven fundamental changes in our understanding of physics and nature
- recognize how the methodology of Galileo, including his mathematical approach for studying change through time, with his improved precision measurements of time, underpins the modern scientific method

- describe the microscopic structure of matter, and how periodic phenomena at this scale are used to keep time
- compare the views on time by Newton and Einstein, and recognize how Einstein fundamentally changed the cosmic worldview
- describe historical experiments which have confirmed predictions of scientific theories and recognize how the constant interplay between theory and observation advances scientific knowledge
- identify parts of the brain and body involved in time perception
- experience and describe examples of duration distortion

Evaluation

2 TERM EXAMS: (dates To Be Confirmed/ pending room booking)
20% Term 1 Exam –Nov 29 (2 hours, Short answer + Mult. choice)
20% Term 2 Exam –Mar 28 (2 hours, Short answer + Mult. choice)

2 MIDTERM EXAMS: (dates To Be Confirmed/ pending room booking)
5% Midterm Exam 1 –Oct18 (1 hour, Mult. choice)
5% Midterm Exam 2 - Feb 7 (1 hour, Mult. choice)

4ASSIGNMENTS: (dates Confirmed)
7.5% Assignment 1 – The Sky as a Timekeeper, due Sept 27
15% Assignment 2 – Clock Assignment, due Nov 8
7.5% Assignment 3 – Time Perception Assignment, due Jan 24
15% Assignment 4 – ROM Assignment, due Mar 7

QUIZZES/CLASS PARTICIPATION:
5% In-class and Homework Quizzes to be held each week (via moodle). Bring a device which allows you to connect to moodle each class. Lowest 2 quiz grades dropped.

In order to be fair and consistent to the entire class, individual grades are not negotiable and "extra credit" assignments are not provided at any point during or after the course. Please contact the instructor about a grade **only** if there is a clear error (calculation, clerical, etc.) within two weeks of the grade being made available to you.

All grades will be posted on **moodle** as soon as they are available. Please notify the Professor immediately if there is a discrepancy in any grade. **Please keep a copy of all assignments and exams until the end of the course, in case of any grade discrepancy.**

Course Materials

- There is no textbook for this course.
- Required readings will be posted as links to websites or ebooks available in the YorkU Library system.
- Links for course ebooks available under 'Course Reserves' on top moodle module

Laboratory/Tutorial

This course does not have a laboratory or tutorial component.

Course Content and Format

All course material can be found on moodle, and is divided into weekly components which include:

- outlines for content covered each lecture
- pdfs for each lecture
- required readings – links to websites or e-books available through York University Library
- required videos
- supplementary notes and worksheets
- review questions for you to do to make sure you have understood the material
    - answers will not be posted, but can be discussed with your classmates using moodle's online forum

Additional information:

- Links to course reserve ebooks are posted under 'Course Reserves' in top moodle module.
- **Check your email regularly.**

Math Content

- This course emphasizes the physical and conceptual bases of important equations (like Newton's Law of gravity) rather than requiring calculations using the equations.
- Simple calculations (with basic arithmetic, exponents, basic geometry) may be discussed and demonstrated in class.
- Graphs commonly used by scientists, including reflectance spectra are discussed.
- Students should be familiar with scientific notation.
- Calculations will not be on tests or exams.

Course Policies

Questions and concerns should be directed to the Professor

- **By moodle: Strongly preferred**
- by email: robin@yorku.ca
- put 'NATS 1795' in the header (so I know it isn't spam)
- include your full name and student number in the email
- please use proper email etiquette: start with Dear Professor; don't use slang or text abbreviations

Assignment Policies

- Some assignments or assignment sections will be handed in via turnitin
- For hardcopy assignments, make sure your full name and student number are on a cover page or at the top of the assignment.
- **Proper references and citations must be given in all assignments.** For information on style guides, see http://www.yorku.ca/caitlin/wstudies/style.htm
- Please familiarize yourself with the Academic Honesty Policy (http://secretariat-policies.info.yorku.ca/policies/academic-honesty-senate-policy-on/) and note that **plagiarism of any sort (direct copying of websites, presenting another's material as your own) is not tolerated**, and will be dealt with according to York University's Senate Policy (link below). Penalties for academic misconduct can range from 0 for an assignment, to expulsion from the University in the case of a second offense.
- **LATE ASSIGNMENTS NOT ACCEPTED**

Exam Policies

- All students must show valid student card during exams.
- Dictionaries, cell phones and other electronic items are not allowed in exam. (Cell phones must be turned off and stored in students' bags during exams.)
- Only pens, pencils, erasers and a student card are permitted on the desk during an exam.

Policy for Missed Exams

- If due to illness or unforeseen emergency, a student must miss a scheduled exam, the Professor (robin@yorku.ca) must be notified by the day the exam is to be written in order to arrange a make-up.
- If sufficient notice is not given, the student will receive a mark of 0 for the test.
- If exam is missed due to illness, please use the York University Attending Physician's statement form.

Re-Grading Policy

- Coursework is marked by markers/TAs. Work may be re-submitted for consideration to the Professor, provided a student has a clear reason for the request (not just an attempt at extra marks). **The Professor may re-grade the entire test or assignment, and the overall grade may go up or down accordingly.**

Student Conduct: in class and online

- Students are required to maintain courteous and respectful communication with all members of our course at all times. Please see the University's Student Code of Conduct (http://oscr.students.yorku.ca/csrr/standards).

Copyright and Intellectual Property

COPYRIGHT LAWS:

Most of the material shown in the lecture videos is protected by copyright law, which states that it is illegal for students to share or distribute copyright materials. Students who violate copyright law are at risk of being sued by the owners of the material.

Some examples of illegal distribution include:

- posting videos of a lecture on a web site, either your own or someone else's
- posting photographs or screen captures of lecture slides on a web site
- posting notes, assignments and other intellectual property to web sites

University Policies

Important Sessional Dates

Includes sessional start and end dates, drop deadlines, and withdrawal dates.
See the Office of the Registrar website at http://www.registrar.yorku.ca/enrol/dates/

Academic Honesty and Integrity

Academic honesty requires that **persons do not falsely claim credit for the ideas, writing or other intellectual property of others,** either by presenting such works as their own or through impersonation. Similarly, academic honesty requires that persons do not cheat (attempt to gain an improper advantage in an academic evaluation), nor attempt or actually alter, suppress, falsify or fabricate any research data or results, official academic record, application or document. Finally, academic honesty requires that persons do not aid or abet others to commit an offence of academic dishonesty, including intentional acts to disrupt academic activities.

Suspected breaches of academic honesty will be investigated and charges shall be laid if reasonable and probable grounds exist.

Academic Honesty and electronic devices during assessments (*e.g.* exams)

- Internet capable and personal storage devices of all kinds must be turned off, including vibrate. These and any other unauthorized material must be placed under the student's chair and should not be accessed at any point during the exam. Failure to comply with directive may be considered a break of academic honesty.
- See http://registrar.yorku.ca/exams/tipsheet
- Please familiarize yourself with the full **Senate Policy on Academic Honesty**, found at http://secretariat-policies.info.yorku.ca/policies/academic-honesty-senate-policy-on/
- Please also familiarize yourself with the **SPARK Academic Honesty tutorial** found at https://spark.library.yorku.ca/academic-integrity-what-is-academic-integrity/

Academic Accommodation for Students with Disabilities

York University shall make reasonable and appropriate accommodations and adaptations in order to promote the ability of students with disabilities to fulfill the academic requirements of their programs.

The nature and extent of accommodations shall be consistent with and supportive of the integrity of the curriculum and of the academic standards of programs or courses.

Please familiarize yourself with the full Senate Policy on Academic Accommodations for Students with Disabilities, found at http://secretariat-policies.info.yorku.ca/policies/academic-accommodation-for-students-with-disabilities-policy/

Note: Students should submit accommodation letters from Counseling and Disability Services (CDS) to the course instructor within the first two weeks of the course or as soon as issued.

Counseling and Disability Services- http://cds.info.yorku.ca/

York Accessibility Hub - http://accessibilityhub.info.yorku.ca/

Note: A student registered with CDS, and choosing to write with Alternate Exams, is responsible for making the appropriate writing arrangements within the timeframes outlined by Alternate Exams.

Alternate Exams - http://altexams.students.yorku.ca/

Religious Observance Accommodation

York University is committed to respecting the religious beliefs and practices of all members of the community, and making accommodations for observances of special significance to adherents.

https://w2prod.sis.yorku.ca/Apps/WebObjects/cdm.woa/15/wo/kmHGekTpzKLX6XYKBXYc8M/0.3.4.62.0

Note: Students who will have an academic conflict as a result of a religious observance, at any point in the term, should make the instructor aware of suchat least three weeks prior to the conflict.

For conflicts occurring during an official examination period, please complete the Examination Accommodation Form available at http://www.registrar.yorku.ca/pdf/exam_accommodation.pdfand submit to your instructor at least three weeks prior to the final exam.

Student Conduct in Academic Situations

Students and instructors are expected to maintain a professional relationship characterized by courtesy and mutual respect and to refrain from actions disruptive to such a relationship. Moreover, it is the responsibility of the instructor to maintain an appropriate academic atmosphere in the classroom and the responsibility of the student to cooperate in that endeavour. Further, the instructor is the best person to decide, in the first instance, whether such an atmosphere is present in the class. A statement of the policy and procedures regarding disruptive and/or harassing behaviour by students in academic situations is available on the website of the University Secretariat (http://secretariat.info.yorku.ca/).

Division of Natural Science Resources

NATS-AID
Free peer tutoring for students enrolled in Natural Science Courses.
Seehttp://natsci.info.yorku.ca/nats-aid/

M-AID in NATS (Math Aid)
Free math help for students enrolled in Natural Science Courses (TA tutors)
See http://natsci.info.yorku.ca/m-aid-in-nats/

Other Resources

Learning Commons
The Learning Commons brings together key supports for your learning: writing, research, learning skills and career services. http://www.library.yorku.ca/cms/learning-commons/

goSAFE
goSAFE is a complimentary service provided to the York Community. At the Keele campus, goSAFE has two routes: North Route & South Route which will safely transport community members by vehicle from one specified hub to another on campus. goSAFE operates seven days a week, all year round, including University closures (with the exception at Glendon during the Christmas holiday closure).

Call the goSAFE office at 416-736-5454 or extension 55454 during hours of operation. Please give your name, location and destination. http://www.yorku.ca/goSAFE/

Mental Health and Wellness at York University
Outlines a variety of resources available to support mental health and wellness
http://mhw.info.yorku.ca/resources/resources-at-york/students/

Good2Talk
Post-Secondary Student 24 hour Helpline
http://www.good2talk.ca/ 1-866-925-5454