

Milestone: Keeping Time

Essl 290 Fall 2020

Instructor:	Professor David Collins
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Office Hours:	M 11:00am - noon, T 10:00 – 11:00am, W 3:00 – 4:00pm, R 2:00 – 3:00pm, F 11:00am - noon
Class Meetings:	MWF 1:00pm – 1:50pm
Course Website:	http://www.coloradomesa.edu/~dacollin/teaching/2020Fall/Essl290/index.html
Required Text:	J. E. Barnett, <i>Time's Pendulum</i> , Harcourt (1998). J. Jespersen and J. Fitz-Randolph, <i>From Sundials to Atomic Clocks</i> , Dover (1999).

Overview

Since ancient times people have developed ever more accurate clocks and timekeeping devices. What are these and how do they work? Why do we need increasingly accurate timekeeping? How has increasingly accurate timekeeping affected our daily lives?

This course aims to explore the history and development of timekeeping. Part of the course material will cover basic ideas about the workings of these devices and the physics and science involved. This will include assessing the type of accuracy needed to use timekeeping devices to accomplish tasks effectively. The course material will also describe the context behind timekeeping. This includes perhaps unexpected diversity of contexts such as the arranging the day in medieval monasteries, early industrial activity in Europe during the Middle Ages, trans-Atlantic navigation, railroads in the 19th century and modern GPS.

The course covers:

1. Time keeping in ancient times.
2. Mechanical clocks.
3. Electronic and atomic clocks.
4. Historical and modern demands from society for accurate time measurement.
5. Implications of time keeping technology for people and society.

Assignments

An undergraduate student should expect to spend on this course a minimum of two hours outside the classroom for every hour in the classroom. The outside hours may vary depending on the number of credit hours or type of course. More details are available from the faculty member or department office and in CMU's Curriculum Policies and Procedures Manual.

1. **Homework Assignments:** There will be regular assignments due in most weeks of the semester. Each will consist of a combination of short exercises involving writing and simple calculations.
2. **Writing Assignments:** There will be three writing assignments (research papers) during the semester. In each you will address a specific statement that is presented as fact in the class or one of the texts and will find one or more additional sources to support or refute the statement. The writing assignment should describe how the additional source supports or refutes the statement. The research papers should be one or two pages long.
3. **Term Paper:** There will be a single final term paper. The first draft will be due on Friday 20 November 2020 and the final draft due on Friday 4 December 2020.

Grades

Individual assignments and exams will be graded using suitable scales. In general, to get full credit (100%) for a question your response must be correct and well justified. Partial credit will be given for incomplete or partly correct responses. No credit (0%) will be given for assignments that were not turned in.

A final numerical score will be computed according to the following distribution.

Regular assignments (total)	30%
First research paper	10%
Second research paper	15%
Third research paper	15%
Final term paper	30%

The following final numerical scores will guarantee letter grades:

90%	A
80%	B
70%	C
60%	D

Grading Rubrics

1. Research Papers:

The purpose of each research paper is to present evidence that supports or refutes a particular assertion or claim (main claim) that emanates from one of the texts required for the course. The claim must be taken from a list provided by the instructor or else must be approved by the instructor prior to submission of the paper. The paper must refer to one or more sources that address the claim; these sources must be reliable (described below). The paper must be written in the form of a short essay. It must contain the following components:

- (a) **Introduction:** The paper must start with paragraph containing a statement of the main claim and a citation for where it was found.
- (b) **Supporting evidence:** The paper must describe at least one source of evidence that addresses the main claim. The paper must provide a complete reference for this source. The evidence must address the main claim and the paper must explain how it accomplishes this. The paper will possibly contain secondary claims or statements of fact that are not commonly known. Each of these must also be supported by a citation to a reference source.
- (c) **Organization of ideas:** The paper will contain a sequence of ideas that lead from the statement of the main claim to the conclusion that either upholds or refutes the claim. The order of these ideas must be logical, no key ideas can be absent and no unrelated ideas or discussions must appear.
- (d) **Grammar:** The report must use standard English grammar, spelling, usage rules and punctuation.
- (e) **Writing style:** Writing should be done in a professional style with a neutral tone. Colloquial or conversational style of language must not appear in the paper. Repeated statements and other forms of verbosity must not appear in the paper.

Reliable sources: A crucial part of your paper will be to cite reliable external sources. A reliable source in this case means something that satisfies:

- (a) **(Independence)** It is not the text from which the assertion or claim is taken.
- (b) **(Review)** The source has been reviewed by an expert other than the author of that source. Most published books and academic journal articles have been reviewed in this way. Most websites have not been reviewed by an expert (exceptions include websites for academic journals, professional societies, museums, newspapers). Wikipedia and YouTube have not been through any formal review process.
- (c) **(Permanence)** The source will likely be available tens or hundreds of years from now. This is true for most items in print. It is not true for most websites

(exceptions include websites for publishing houses, academic journals and newspapers, all of which have procedures for archiving online articles). Wikipedia or YouTube do not provide assurance for the permanence of their content; it can be removed or altered in seconds.

The grade for the each research paper is assessed according to the following rubric. The relative weight of each component toward the total grade is indicated.

Score	0	1	2	3	4
Introduction (10%)	None present.	Misses one of: a clear description of the main claim and where it was found.	Includes both of: a description of the main claim and where it was found. Contains statements that are unrelated to the issue.	Includes both of: a description of the main claim and where it was found. The description of the main claim is unclear.	Includes both of: a clear description of the main claim and where it was found.
Supporting evidence (40%)	No supporting evidence is provided.	Supporting evidence is provided by sources whose reliability is unclear. These might be able to address the main assertion satisfactorily but they were not used to do so.	Supporting evidence is provided by reliable sources. These might be able to address the main claim satisfactorily but they were not used to do so. OR Supporting evidence is provided by sources whose reliability is unclear. These are used to address the main claim satisfactorily. The sources address fewer than 70% of the other assertions in the paper satisfactorily.	Supporting evidence is provided by reliable sources. These are used to address the main claim satisfactorily. The sources address fewer than 70% of the other assertions in the paper satisfactorily. OR Supporting evidence is provided by sources whose reliability is unclear. These are used to address the main claim satisfactorily. These are used to address at least 70% of the other assertions satisfactorily.	Supporting evidence is provided by reliable sources. These are used to address the main claim satisfactorily. The sources address at least 70% of the other assertions in the paper satisfactorily.
Organization of ideas (30%)	There are no ideas related to the claim. All material is extraneous.	Some key ideas are absent and there is substantial extraneous material.	Some key ideas are absent or there is substantial extraneous material.	The key ideas are all present, but need rearrangement to give a logical order and there is no extraneous material.	The key ideas are all present, are in a correct logical order and there is no extraneous material.
Grammar (10%)	More than 50% of sentences require correction.	Between 50% and 10% of sentences require correction.	Between 10% and 5% of sentences require correction.	Between 5% and 1% of sentences require correction.	Less than 1% of sentences require correction.
Writing Style (10%)	Writing always displays stylistic issues such as colloquial language or verbosity.	Writing usually displays stylistic issues such as colloquial language or verbosity.	Writing often displays stylistic issues such as colloquial language or verbosity.	Writing sometimes displays stylistic issues such as colloquial language or verbosity.	Writing needs little modification.

2. Term Paper:

The final draft for the term paper will be assessed according to a rubric which refers to various components. These are:

- (a) **Introduction:** The body of the paper must begin with an introduction that briefly describes the issue or question that the paper addresses. The introduction must describe what the issue is, what the broader context of the issue is and why the issue is interesting or important.
- (b) **Order of Ideas:** Any paper or article will be structured around a series of ideas that build upon each other. If one of these is missing or is out of place then the analysis or argument offered by the paper will make no sense or be unconvincing to the reader. In the paper, the crucial ideas must be present and in logical order.
- (c) **Supporting evidence:** The paper will require evidence from reliable external sources to support its arguments and analysis. Such evidence must be presented in the paper and used to support the arguments of the paper. The paper will possibly contain claims and statements of fact that are not commonly known. Each of these must also be supported by a citation to a reference source. Citations and references must be included.
- (d) **Grammar:** The report must use standard English grammar, spelling, usage rules and punctuation.
- (e) **Writing style:** Writing should be done in a professional style with a neutral tone. Colloquial or conversational style of language must not appear in the paper. Repeated statements and other forms of verbosity must not appear in the paper.
- (f) **Revisions:** Revisions will be suggested after the first draft of the paper is submitted; these must be addressed.

Reliable sources: A crucial part of your paper will be to cite reliable external sources. A reliable source in this case means something that satisfies:

- (a) **(Review)** The source has been reviewed by an expert other than the author of that source. Most published books and academic journal articles have been reviewed in this way. Most websites have not been reviewed by an expert (exceptions include websites for academic journals, professional societies, museums, newspapers). Wikipedia and YouTube have not been through any formal review process.
- (b) **(Permanence)** The source will likely be available tens or hundreds of years from now. This is true for most items in print. It is not true for most websites (exceptions include websites for publishing houses, academic journals and newspapers, all of which have procedures for archiving online articles). Wikipedia or YouTube do not provide assurance for the permanence of their content; it can be removed or altered in seconds.

The grade for the term paper is assessed according to the following rubric. The relative weight of each component toward the total grade is indicated.

Score	0	1	2	3	4
Introduction (10%)	None present.	Misses two of: a clear description of the issue addressed, broader context and why it is interesting.	Misses one of: a clear description of the issue addressed, broader context and why it is interesting.	Includes all of: a clear description of the issue addressed, broader context and why it is interesting. There is some superfluous content.	Includes all of: a clear description of the issue addressed, broader context and why it is interesting. There is no superfluous content.
Order of Ideas (20%)	The number of major ideas that need to be moved, added or removed is more than 75% total number of major ideas.	The number of major ideas that need to be moved, added or removed is between 75% and 50% of the total number of major ideas.	The number of major ideas that need to be moved, added or removed is between one and 50% of the total number of major ideas.	Only one major idea needs to be moved, added or removed.	No major ideas need to be rearranged.
Supporting evidence (30%)	No supporting evidence is provided.	Supporting evidence is provided by reliable sources and might be used to only address fewer than 25% of the of the claims and assertions in the paper satisfactorily. At least 20% of the remaining claims and assertions in the paper are addressed satisfactorily by sources whose reliability is unclear. OR Supporting evidence is provided by sources whose reliability is unclear and these are used to only address between than 25% and 50% of the of the claims and assertions in the paper satisfactorily. The remaining claims and assertions in the paper are not supported at all.	Supporting evidence is provided by reliable sources and these are used to only address between 25% and 50% of the of the claims and assertions in the paper satisfactorily. At least 20% of the remaining claims and assertions in the paper are addressed satisfactorily by sources whose reliability is unclear. OR Supporting evidence is provided by reliable sources and these are used to only address between 50% and 80% of the of the claims and assertions in the paper satisfactorily. The remaining claims and assertions in the paper are not supported at all.	Supporting evidence is provided by reliable sources and these are used to only address between 50% and 80% of the of the claims and assertions in the paper satisfactorily. At least 20% of the remaining claims and assertions in the paper are addressed satisfactorily by sources whose reliability is unclear.	Supporting evidence is provided by reliable sources and these are used to address at least 80% of the claims and assertions in the paper satisfactorily.
Grammar (10%)	More than 50% of sentences require correction.	Between 50% and 10% of sentences require correction.	Between 10% and 5% of sentences require correction.	Between 5% and 1% of sentences require correction.	Less than 1% of sentences require correction.
Writing Style (10%)	Writing always displays stylistic issues such as colloquial language or verbosity.	Writing usually displays stylistic issues such as colloquial language or verbosity.	Writing often displays stylistic issues such as colloquial language or verbosity.	Writing sometimes displays stylistic issues such as colloquial language or verbosity.	Writing needs little modification.
Revisions (20%)	Less than 25% of revisions have been addressed.	Between 25% and 50% of revisions have been addressed.	Between 50% and 75% of revisions have been addressed.	Between 75% and 100% of revisions have been addressed.	All revisions have been addressed.

Policies

1. **Helpful Resources:** The Tutorial Learning Center (TLC) is a *free* academic service for all CMU students. Tutors are available in Houston Hall 113 on a walk-in basis for many courses. More information is available at www.coloradomesa.edu/tutoring or 248-1392.

In coordination with Educational Access Services, reasonable accommodations will be provided for qualified students with disabilities. Students must register with the EAS office to receive assistance. Please meet with the instructor the first week of class for information and/or contact Samantha Dieguez, the Coordinator of Educational Access Services, directly by phone at 248-1801, or in person in Houston Hall, Suite 108.

2. **Withdrawals:** There are several ways to drop this course. The deadline for dropping without penalty is **1 September 2020**. Please consult the CMU academic calendar and catalog for more details about adding and dropping courses.
3. **Attendance:** Attendance policies are described in the CMU catalog. You are expected to attend all the class meetings. In case of illness or other emergencies you must be able to produce the appropriate documentation. There are other circumstances under which you can be excused but you must discuss these with me in advance. If you miss a class or lab for a valid reason, turn in any assignments due before the start of the next class. Assignments turned in beyond your return to class will not be accepted.

If there is an unavoidable conflict with one of the class exams or the final exam, please discuss it with me as soon as possible. In general I will assume that the final exam will have priority, since you know the dates of the exam.

4. **Academic integrity:** You are expected to present your own work in assignments, exams and quizzes. Fabrication of data, plagiarism, and copying from anyone else, particularly in closed book exams, are serious violation of academic norms. CMU has extensive policies on these matters and penalties for infringement can be severe. For more details, consult the academic integrity policies in the CMU catalog.

Student Learning Outcomes

This course is a critical component of CMU's Essential Learning Curriculum and a CMU Degree. In addition to knowledge in the course content area, this class will provide specific learning opportunities in the following areas:

1. Produce effective arguments and summaries in written English.
2. Critically examine and evaluate an argument.
3. Construct an academic project using techniques and methodologies from multiple disciplines.

Schedule

The following schedule is tentative.

Week	Dates	Topic
1	8/17– 8/21	Introduction, time units.
2	8/24 – 8/28	Astronomical timekeeping.
3	8/31 – 9/4	Sundials and water clocks.
4	9/7 – 9/11	Mechanical clocks.
5	9/14 – 9/18	Mechanical clocks, First research paper due.
6	9/21 – 9/25	Clocks and navigation.
7	9/28 – 10/2	Clocks and navigation.
8	10/5 – 10/9	Standardizing time, Second research paper due.
9	10/12 – 10/16	Standardizing time.
10	10/19 – 10/23	Electronic clocks.
11	10/26 – 10/30	Electronic clocks, Third research paper due.
12	11/2 – 11/6	Atomic clocks.
13	11/9 – 11/13	Atomic clocks.
14	11/16 – 11/20	Uses of atomic clocks, First draft term paper due.
15	11/23 – 11/27	Thanksgiving (no classes).
16	11/30 – 12/4	TBA, Final draft term paper due.