Course Information: Spring 2001

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| Course | CORE 121 Extended Study / The Monument Mathematics |
| Meetings | TBA |
| Instructor | K. G. Valente / 202 McGregory / x. 7247 / email to kvalente@mail.colgate.edu |
| Office Hours | Monday: 1.00 - 1.50; Wednesday 2.00 - 2.50; Thursday 9.30 - 10.20; or by appointment |
| Webpage | http://math.colgate.edu/faculty/valente.html |
| Required texts | E. A. Abbott, Flatland: A Romance of Many Dimensions<br>G. H. Hardy, A Mathematician's Apology<br>A. Hodges, Alan Turing: The Enigma<br>R. Kanigel, The Man who Knew Infinity<br>C. P. Snow, The Two Cultures<br><br>These titles should all be available in the bookstore. Other readings will either be placed on two-hour reserve in the Cooley Science Library or available via the course website. |

Program & Policies

Course outline This Scientific Perspectives course examines the modern history of mathematics, science, and technology while maintaining both disciplinary and social perspectives. Built upon the 'crisis in foundations' that confronted mathematics in the nineteenth century, roughly the first two-thirds of the syllabus for CORE 121 examines the special nature of mathematical knowledge and how this knowledge develops. This portion of the syllabus also considers the aesthetic, heuristic, and utilitarian aspects of the discipline as well as the mathematization of areas of knowledge as an example of the increasing specialization that, in part, gave rise to C. P. Snow's Two Cultures thesis. These investigations come together in the final portion of the course by examining the development of modern computing technology in Britain, which has its genesis in both the aforementioned crisis in foundations and the analysis of mechanical codes in during World War II.

In an extended study format, the natural shift in the syllabus (from general discussions to a specific case study) marks the end of the on-campus meetings and the beginning of the field component. The specific structure for this extended study course will entail two 50-minute sessions per week while at Colgate with the remaining sessions (approximately 15) taking place in England. A three-week field component has been adopted in order to maintain a flexible academic schedule, allow students time for research, and encourage personal exploration.

Extended study This course has been designed to feature an extended study component in England offering experiences that would not be available to students while at Colgate. In particular, visits to many world-famous museums devoted to the history of science and technology and lectures by local scholars will be scheduled. The following is a tentative itinerary for the three-week field component. Further information will be provided during the semester.

> London: 22-28 May (Week 1) Charles Babbage features in both parts of CORE 121, and his work provides a 'bridge' between the old and new worlds of mathematics across the crisis in foundation. A

nineteenth century mathematician, he believed that science and technology would provide solutions to many social problems and strongly advocated for government-sponsored research. The Science Museum in London features the only complete working model of Babbage's Difference Engine, the forerunner of mechanical multi-purpose computing equipment. Although twentieth century computing pioneers were scarcely aware of Babbage's ideas, their work certainly takes place in his very long shadow. It is fitting that the British component of the course should begin by reconsidering this machine and its inventor in a session with Doron Swade, a Babbage scholar and the leader of the team responsible for the modern construction of the Difference Engine.

Babbage's plans for the Difference Engine, and the creation of a working model based on these, prove that the idea of computing machinery truly belongs to the nineteenth century. Why, then, did computers not become a reality for another 100 years? There is no simple answer, but one reason is that World War II made fast and reliable computing machines a necessity. Discussions about the 'secret war' of cryptography that became more prominent in World War II will be enhanced by a trip to the Imperial War Museum where a permanent exhibit has been dedicated to this topic.

While based in England students will be able to spend a day at the recently established museum at Bletchley Park where British code-breaking activities were carried out. This visit will allow students to view the reconstructed Colossus, the machine developed to break the mechanically created Enigma code. The Colossus is historically significant because it is one of the first machines to embody mathematical logic and is a starting point for the computing technology that would be more fully developed during the 1940s.

Manchester: 29 May - 11 June (Weeks 2 & 3) Once in Manchester, the course will continue to focus on the ramifications of British code-breaking activities. An important consequence of the work at Bletchley Park is the development of computing technology in the late 1940s. The course in Manchester will have the ability to call upon the resources of both the Manchester Science & Industry Museum (MSIM) and the National Archive for the History of Computing. Permanent exhibit space in MSIM has recently been devoted to a working model of the first electronic stored-program computer in the world, affectionately named 'the Baby,' which ran in Manchester in 1948.

Finally, as a capstone session, Andrew Hodges of Wadham College, Oxford, will meet with the students (at Oxford if possible) for a discussion on the impact of mathematics (and science) on our modern world. A mathematician by training, his 1983 biography Alan Turing: The Enigma provides one of the first detailed accounts of the work done at Bletchley Park as well as the post-war development of electronic computers. This book, which anticipated the rise of popular books that speak directly to science within an socio-historical context and inspired the critically-acclaimed play Breaking the Code, will be the primary text for the extended study component of the course.

All students must complete the extended study sessions in order to receive credit for this course.

Attendance and participation (15%) This course will involve a mixture of lectures and discussion. Consequently, your attendance and participation are important and will contribute to your final grade. Weekly reading assignments will be posted to the course website. Be sure to check this site often for updates and announcements.

In addition to our regular meetings, you will be required to attend the Science Colloquium on Friday, 2 February, at 3.30 in 209 Lathrop. At this time, Andrew Hodges of Oxford University will be speaking on the history and philosophy of artificial intelligence. Although you will return to this material later in the semester and meet with Dr Hodges again in England, this will be an opportunity to hear about some important ideas regarding mathematics in the twentieth century.

Course assignments The writing assignments associated with this course fall into three categories.

Mathematical reasoning assignments (20%) As a CORE Scientific Perspectives offering, this course must introduce students to the methodology of the discipline under investigation. In this spirit, three short assignments will be set. The first two of these are devoted to the construction of mathematical proofs and will involve several draft submissions throughout the semester. Your mark on these assignments will be determined from a final portfolio submission (approximately 6-8 pages) due on 4 May. The third assignment will be a group activity set during the extended study component of the course. More information regarding these assignments will be available on the course website.

Short papers (30%) Two short papers will be set during the semester. Each of these should be 7-8 pages in length. The first will be due 21 March and the second 25 April. Topics for these papers will be announced.

Long paper (35%) There will be a longer research paper (12-15 pages) attached to the extended study component. The topic(s) for the paper will be determined so as to emphasize either the experiential aspects of this part of the course and/or research materials that are available in Manchester. Primary research will need to be conducted on-site and a required annotated bibliography for this material must be submitted before leaving England. However, final papers would not be due until 1 July 2001 in order to allow students the opportunity to take advantage of word processing equipment that will not be available on-site and/or complete any traveling that they may wish to do after the program ends.