March 17, 2003

# MEMORANDUM

From: Don Brutzman, Associate Professor, Code UW/Br and MOVES Institute

To: Academic Council (Chair, Course Review Committee)

Via: Chair, Modeling Virtual Environments and Simulation (MOVES) Institute

Dean, Computer and Information Sciences and Operations (CISO)

Associate Provost for Instruction

Subject: PROPOSED COURSE: HAMMING LEARNING TO LEARN (MV 4000)

Encl: (1) Online archive

*[http://online.cs.nps.navy.mil/DistanceEducation/](http://online.cs.nps.navy.mil/DistanceEducation/  NpsContent/Courses/HammingLearningToLearn/session.html)*

*[NpsContent/Courses/HammingLearningToLearn/session.html](http://online.cs.nps.navy.mil/DistanceEducation/  NpsContent/Courses/HammingLearningToLearn/session.html)*

(2) Course history [*http://web.nps.navy.mil/~brutzman/hamming/hamming.html*](http://web.nps.navy.mil/~brutzman/hamming/hamming.html)

1. **Proposal**. Eight years of effort in properly digitizing video and properly preparing course materials suitably for Web distribution have finally reached fruition. Richard W. Hamming’s capstone course “Learning to Learn: Future of Science and Engineering” (originally EC4000) has been fully digitized and placed online. This course presents the distilled career insights of a preeminent thinker. In 1968 Dr. Hamming was recipient of the Turing Award, the highest honor in computer science, for his work on numerical methods, automatic coding systems, and error-detecting and error-correcting codes. Among many other awards, he is also namesake for the IEEE Hamming Medal. I hereby propose that a renewed version of this course *MV/CS 4000 - Hamming Learning to Learn* be jointly offered by the Modeling Virtual Environments and Simulation (MOVES) Institute and Computer Science Department. This course is a logical offering for all NPS masters students in science and engineering curricula, and is especially noteworthy for Ph.D. students since the course covers many principles of basic research. Similar to the original course, it includes three hours of video per week, chapter reading, and adds a 2-hour weekly discussion session. Thus I plan to offer it as a (3-2) credit pass-fail course, which slightly exceeds the requirements of the original course. Students will be required to write an essay on how the issues covered in the course relate to their research endeavors. The course material deals with numerous issues of fundamental importance and is of interest to students in science and engineering departments.
2. **Description of the course**. "The Art of Doing Science and Engineering: Learning to Learn" was the capstone course by Dr. Richard W. Hamming (1915-1998) for graduate students at the Naval Postgraduate School (NPS) in Monterey California. This course is intended to instill a "style of thinking" that will enhance one's ability to function as a problem solver of complex technical issues. With respect, students sometimes called the course "Hamming on Hamming" because he relates many research collaborations, discoveries, inventions and achievements of his own. This collection of stories and carefully distilled insights relates how those discoveries came about. Most importantly, these presentations provide objective analysis about the thought processes and reasoning that took place as Dr. Hamming, his associates and other major thinkers, in computer science and electronics, progressed through the grand challenges of science and engineering in the twentieth century.
3. **Resources.** I sat through this course three times, twice as an NPS student. In 1995 this was the first course multicast live on the Internet via the Multicast Backbone, reaching 6-40 people three times per week with each session. We recorded this series in the Engineers’ Auditorium on VHS tape. The online archive is large, approximately 20GB total. Following his summary Superintendent’s Guest Lecture (SGL) from 1990, we present each of 30 classes. Each is matched by a detailed book chapter. This quarter I am presenting the course to half a dozen advanced students, concentrating both on the material as well as pedagogy for best presenting this distance-learning material. I am further adding overview slidesets for each session. Of note: it is impossible and counterproductive to address such dense and anecdotal material in a literal slideset. Instead, broad themes are sketched and specific diagrams are incorporated, thus facilitating student comprehension and group dialog. Scanned pages from the original course notes are online, and the collected notes are available as a book.

Hamming, Richard W., *The Art of Doing SCIENCE and Engineering: Learning to Learn*, Gordon and Breach Science Publishers, Amsterdam B.V, The Netherlands, October 1997. ISBN 9056995006.

1. **Prerequisite considerations**. Given the simultaneous intensity and breadth of this work, I believe it is more than sufficiently challenging to be listed at the 4000 level. I'd also like to respect his opinion of the course, and thus want to maintain the same number, indicating that we have captured and continue to offer the same course. Even so, prerequisite requirements can be a bit tricky. The course material straddles computer science, electrical engineering, mathematics, information theory, simulation, artificial intelligence and other topics – but these are all technically detailed backdrops used to illustrate numerous questions and principles regarding learning and research. I think the primary prerequisite is that the students are sufficiently advanced in their work and research that they are able to grapple with the challenging ideas presented. Meanwhile, since the course can be so influential, we don't want to exclude earlier students who are prepared to handle it. Planned prerequisite: over six months of graduate study, or permission of instructor.
2. **Justification and Details**: This course is a key resource for NPS, now and in the foreseeable future. I plan to contact Mrs. Hamming (if possible) and the book publishers about public availability of this significant new resource. This is a terminal (non‑prerequisite) course that can enhance many Educational Skill Requirements (ESRs). This course is unclassified.
3. **Duplication**: This course does not duplicate any other existing course content at NPS.
4. **Suggested timetable for implementation**: immediate. Proposed schedule is twice per year, winter and summer quarters.

Very respectfully,

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