Telecommunications Engineering:

A Unique University/Industry Course Partnership At Carleton University

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Initiated in 1990, this Telecommunications Engineering course provides a comprehensive overview of telecommunications through a cooperative teaching alliance among Carleton University, the telecommunications industry, the federal government and the CRTC - a stimulating decade of course evolution at the edge of the third millennium.

Mis sur pied en 1990, ce cours d'ingénierie des télécommunications apporte une vue d'ensemble sur les télécommunications via les professionnels de « Carleton University », l'industrie des télécommunications, le gouvernement fédéral et le CRTC - une stimulante décennie d'évolution, à l'aube du troisième millénaire.

1.0 Background

Universities world-wide are introducing innovative approaches for engineering education [1,2]. One example of these paradigm shifts was initiated in 1990 in Ottawa through a joint venture between Bell Canada and Carleton University's Department of Systems and Computer Engineering. The result was the beginning of a challenging industry-based accredited course entitled “Telecommunications Engineering” for senior undergraduate and graduate students in Electrical Engineering and Computer Systems Engineering degree programs. It is now also a capstone course in Carleton's recently initiated Communications Engineering degree program. The Telecommunications Engineering course complements other Carleton courses such as Communication Theory, Digital Communications, Computer Communications, RF Lines and Antennas, and Telecommunications Circuits.

The objective of the course is two-fold:

- to encompass an integrated and holistic perspective of the broad concept of telecommunications from the viewpoints of technology, networking and business, and
- to provide more creative, knowledgeable, and productive human resources for the rapidly-expanding and competitive information age.

The goal has been achieved by a cooperative teaching alliance between the university and lecturers from the telecom industry, Federal Government and the Canadian Radio-television Telecommunications Commission (CRTC). The teaching team for 1999 included 22 lecturers: university (1), industry (14), Federal Government (2), CRTC (1), Consultants (4). Contributing industry members currently include Bell Canada, Doscom Enterprises, Newbridge Networks, PSINet, Spacebridge, Nortel Networks, and Stentor.

2.0 Course Content

The course program (13 weeks, 36 lecture hours) portrays an overview of telecom network architecture through an interactive web of transmission, signalling, switching and teletraffic operations. Included is the role of technical standards for ensuring network interoperability and interconnectivity on a global basis through cooperation with the ITU[3]. The focus is on fundamental network concepts and principles including: packet switching, Asynchronous Transfer Mode (ATM), broadband network transport and access, wireless and satellite systems, engineering economics, network planning, management and control, Signalling System No. 7, network synchronization, Intelligent Networks, Personal Communication Services (PCS), the rapidly-expanding Internet and the continuing convergence of all aspects of telecom services (data, voice, video, etc.) towards a seamless global network. The program concludes with a review of Canadian telecommunication corporations, the Federal Government's telecom policies and network security, as well as CRTC regulatory issues stimulated by ever-increasing competition in the global telecom scene. The lecture contents and format are continually revised and updated to reflect the rapid evolution of the industry.

Telecommunication:

“Any transmission, emission or reception of signs, signals, writing, images and sounds or intelligence of any nature by wire, radio, optical or other electromagnetic systems.”

- International Telecommunication Union (ITU)

Field visits to on-site operation centres provide an invigorating learning experience. These include the International Network Management Centre (INMC) administered by Stentor, and a tour through a large Bell Canada Central Office (CO). Among the assignments in the course is a design project; for example the 1999 project involved the technology and layout specification for a competitive local exchange carrier (CLEC) to provide a wide range of telecommunications services to companies in an industrial park. A course notebook, updated annually by the lecturers, is made available for students, including copies of lecture slides in addition to supplementary information. The role of the University's Course Coordinator includes an annual reformulation of the lecture team and lecture scheduling, as well as presiding at each lecture to assess course quality. Feedback from students and lecturers is also important in assuring continued course improvement. Over 500 students have participated in the program during its first decade (1990-99).

3.0 Benefits Of The Course

A prime factor for course success is the hands-on technical and managerial experience of the lecture team. The students benefit by seeing how fundamental communications, economic and managerial principles come together to form telecommunications networks and systems. The industry clearly benefits from graduates who are knowledgeable in the overall telecom picture and therefore prepared to contribute quickly and more effectively to the dynamic telecom world. Potential employers see the course as a plus on resumés of graduating students. Several of the 1999 course lecturers from industry had previously taken the course when they were Carleton engineering undergraduates. The course program is but one trend in the monumental on-going task of re-engineering the educational infrastructure in response to the current and future demands in all aspects of telecommunications.

4.0 References

[1]. Partnerships - Opportunities in Engineering Education. Proceedings of the Engineering Education Conference held in Edmonton, Alberta, June 26-29, 1994, co-sponsored by the American Society of Engineering Education (ASEE) and the Canadian Conference on Engineering Education (CCEE). Vols. I/II "Telecommunications Engineering - A University/Industry/Government Teaching Alliance at the Edge of the 21 Century", Malcolm J. Bibby and Robert N.E. Haughton, Volume 1, p.825.

[2]. IEEE Spectrum magazine. Volume 22,No.9, September 1995. "Educating the Renaissance Engineer". Linda Guppert, p.39. "Re-Engineering Engineering Education". C.G. Maic, p.44.

[3]. International Telecommunication Union (ITU): United Nations Agency for development of Information Technology Standards Recommendations. Geneva, Switzerland.

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About the Authors

Robert Haughton was with Bell Canada until 1983 in managerial and ITU standards committee roles. Since then he has focused on the development of a teaching alliance between Carleton University, the telecom industry, Federal Government and the CRTC.

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