

COVER SHEET - NEW and REVISED COURSES

Commission on Undergraduate Studies and Policies / Commission on Graduate Studies and Policies / University Core Curriculum Committee  
Effective August 1993

*Approved  
11-14-02*

- SEE I - VIII for Basic Course Proposal Guidelines •
- SEE APPENDIX FOR NOTES, EXPLANATIONS AND ADDITIONAL GUIDELINES •
- PRINT CLEARLY, TYPE or COMPLETE ELECTRONICALLY •

APPROVED  
CGC 11-14-02  
CGSP 11-20-02

PROPOSAL DATE: July 26, 2001

BEGIN FIFTEEN DAY REVIEW  
END FIFTEEN DAY REVIEW

DEPARTMENT AND COURSE NUMBER: ELECTRICAL AND COMPUTER ENGINEERING 5565-5566  
COMPUTER SCIENCE 5565-5566

*11-22-02  
mch*

TITLE OF COURSE: NETWORK ARCHITECTURE AND PROTOCOLS

TRANSCRIPT (ADP) TITLE (MAX-30 Characters): NETWORK ARCH AND PROTOCOLS

INSTRUCTOR and/or DEPARTMENTAL CONTACT: S. F. Midkiff

CONTACT PHONE #: 1-5190

CONTACT E-MAIL: midkiff@vt.edu

CHECK IF GRADUATE CREDIT IS REQUESTED (15 copies required for CGSP)

CHECK ONLY ONE OF THE FOLLOWING BOXES

- NEW COURSE
- REVISED COURSE (REVISION >20%) COMPLETE I-VI AND A-G WHERE APPLICABLE
- NEW COURSE & INCLUSION IN THE CORE COMPLETE I-VI AND A-G WHERE APPLICABLE
- REVISED COURSE FOR INCLUSION IN THE CORE OR AREA CHANGE COMPLETE I-VI AND A-G WHERE APPLICABLE

\*Courses routed directly to the University Core Committee MUST be endorsed by the appropriate Department Head or Dean.  
\*The Chair of the University Core Committee shall inform the appropriate college curriculum committee of all courses under review by the core committee.

•A Attach Appropriate Letters of Support from Affected Departments and/or Colleges

•B Effective Semester: Spring 2003

•C Change In Title From:

To:

•D Change in Lecture and/or Lab Hours From: N/A To: 3

•E Change in Credit Hours From: N/A To: 3

•F Percentage of Revision from Current Syllabus: N/A

•G Course Number(s) and title(s) to be Deleted from the Catalogue with APPROVAL of course:

ECE/CS 5516: Computer and Network Architecture II

16192021222324

•FOR ALL COURSES, NEW, CORE AND REVISED: Attach statement from Dean or Departmental Representative as to whether teaching this course will require or generate the need for additional departmental resources.

APPROVAL SIGNATURES / DATES

Department Representative

College Curriculum Committee Representative

College Dean

*[Handwritten signatures and dates]*  
9/19/02  
9/19/02

# COVER SHEET - NEW and REVISED COURSES

Commission on Undergraduate Studies and Policies / Commission on Graduate Studies and Policies / University Core Curriculum Committee  
Effective August 1993

- SEE I - VIII for Basic Course Proposal Guidelines•
- SEE APPENDIX FOR NOTES, EXPLANATIONS AND ADDITIONAL GUIDELINES•
- PRINT CLEARLY, TYPE or COMPLETE ELECTRONICALLY•

PROPOSAL DATE: July 26, 2001

BEGIN FIFTEEN DAY REVIEW

END FIFTEEN DAY REVIEW

DEPARTMENT AND COURSE NUMBER: ECE/CS 5565-5566

TITLE OF COURSE: Network Architecture and Protocols

TRANSCRIPT (ADP) TITLE (MAX-30 Characters): NETWORK ARCH AND PROTOCOLS

INSTRUCTOR and/or DEPARTMENTAL CONTACT: Verna Schuetz, CS Department

CONTACT PHONE #: 1-6931

CONTACT E-MAIL: schuetzv@vt.edu

CHECK IF GRADUATE CREDIT IS REQUESTED (15 copies required for CGSP)

CHECK ONLY ONE OF THE FOLLOWING BOXES

NEW COURSE

REVISED COURSE (REVISION > 20%)

NEW COURSE & INCLUSION IN THE CORE

REVISED COURSE FOR INCLUSION IN THE CORE OR CORE AREA CHANGE

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•The Chair of the University Core Committee shall inform the appropriate college curriculum committee of all courses under review by the core committee.

- A Attach Appropriate Letters of Support from Affected Departments and/or Colleges
- B Effective Semester: Spring 2003
- C Change in Title From: \_\_\_\_\_  
To: \_\_\_\_\_
- D Change in Lecture and/or Lab Hours From: \_\_\_\_\_ To: \_\_\_\_\_
- E Change in Credit Hours From: \_\_\_\_\_ To: \_\_\_\_\_
- F Percentage of Revision from Current Syllabus: \_\_\_\_\_
- G Course Number(s) and Title(s) to be Deleted from the Catalogue with APPROVAL of course:  
ECE/CS 5516: Computer and Network Architecture II

•FOR ALL COURSES, NEW, CORE AND REVISED: Attach statement from Dean or Departmental Representative as to whether teaching this course will require or generate the need for **additional** departmental resources.

APPROVAL SIGNATURES / DATE

Department Representative

Verna Schuetz 6/18/02

College Curriculum Committee Representative

Virginia C. Fowler 15 October 2002

College Dean

Diana C. Erickson 10/17/02

ELECTRICAL AND COMPUTER ENGINEERING 5565-5566  
COMPUTER SCIENCE 5565-5566

NETWORK ARCHITECTURE AND PROTOCOLS

Home Department: Electrical and Computer Engineering

**PART I.**

- Catalog Description:

ECE/CS 5565-5566: NETWORK ARCHITECTURE AND PROTOCOLS

5565: Principles and concepts of networking and protocols, with emphasis on data link, network, and transport protocols. Contemporary and emerging networks and protocols to illustrate concepts and to provide insight into practical networks including the Internet. Quantitative and qualitative comparisons of network architectures and protocols. 5566: Performance evaluation, design, and management of networks. Use of queuing and other analytical methods, simulation, and experimental methods to evaluate and design networks and protocols. Network management architectures and protocols.

Pre: 5565: Graduate standing in EE, CPE, CS, IT; STAT 4714. (3H, 3C);  
5566: (3H, 3C).

- Course Number: ECE/CS 5565-5566
- Transcript Title: NETWORK ARCH AND PROTOCOLS

**PART II.**

- Major, Measurable Learning Objectives

Having successfully completed this course, the student will be able to:

5565:

- (a) Describe the relationships and features of each layer in the ISO Open Systems Interconnect reference model;
- (b) Describe the features and evaluate the performance of automatic retransmission request schemes for error recovery in point-to-point links;
- (c) Describe the features and evaluate the relative performance of common medium access control protocols;
- (d) Describe the features and evaluate the first-order performance of standard switched data networks;

- (e) Describe the features and evaluate the first-order performance of standard routing protocols for internetworks;
- (f) Explain the operation of standard congestion control and flow control algorithms and their use for traffic management and quality of service;
- (g) Explain the operation of protocols in the Transmission Control Protocol/Internet Protocol (TCP/IP) protocol suite;
- (h) Describe the requirements imposed by differentiated services on resource management, admission control, and congestion control;
- (i) Describe software and hardware technologies to realize high data rate networks; and
- (j) Create and analyze state transition diagrams that describe the behavior of TCP and other common protocols.

5566:

- (k) Use analytical models to evaluate the relative performance of single and multiple queue systems used to model networks and protocols;
- (l) Describe traffic models used for packet-switched and circuit-switched traffic and discuss the concept of self-similarity and its applicability to traffic modeling;
- (m) Design simulation experiments, develop traffic models, develop network models, and analyze results for evaluating the performance of queues, local area networks, internetworks, and protocols;
- (n) Apply modeling and network design techniques, including graph theory principles, to design access and backbone networks based on performance objectives and design constraints; and
- (o) Describe the operation of common network management protocols and explain the use of network management tools and network monitors to determine network performance and operational problems.

### **PART III. Justification**

- Reason for Teaching the Course:

Computer networks and the associated protocols form the basis for modern data communications that is at the heart of information technology and the Internet. Knowledge of networking and protocols is important not only for networking professionals, but also for engineers and computer scientists concerned with communications, computer systems, or distributed applications. The design, deployment and management of effective computer networks and protocols requires the ability to analyze the performance of network designs, analyze the efficiency and correctness of protocols, and use network management tools to determine current network operating parameters. This course sequence provides requisite knowledge for network and protocol researchers, network and protocol designers, and advanced network managers.

- Level Justification:

This course builds on the base of knowledge developed in a standard electrical engineering, computer engineering, computer science, or similar undergraduate program, including understanding of the fundamentals of computer systems and probability. Graduate standing is expected in electrical engineering, computer engineering, computer science or similar field since an understanding of system-level issues and an ability to undertake self-directed projects are developed in upper division undergraduate courses in these disciplines.

- Modification:

This proposal is for a new sequence, ECE/CS 5565-5566. Some of the topics in this sequence have been included in the past in ECE/CS 5516. ECE/CS 5516 will be eliminated when ECE/CS 5565-5566 is established. ECE/CS 5515 will be modified and renumbered to become a stand-alone course on computer architecture (ECE/CS 5504). The proposal for ECE/CS 5504 is being submitted separately.

#### PART IV. Prerequisites and Co-requisites

5565: Students should understand computer organization, as required in most electrical engineering, computer engineering, and computer science undergraduate programs. Students should also have a background in calculus-based probability theory, as in STAT 4714, to undertake queuing theory, traffic modeling, and other topics related to performance evaluation.

#### PART V. Texts and Special Teaching Aids

- Required Texts:

5565: J. F. Kurose and K. W. Ross, *Computer Networking: A Top-Down Approach Featuring the Internet*, 2001, x, 712 pp. (ISBN 0-201-47711-4).

5566: Thomas G. Robertazzi, *Computer Networks and Systems: Queueing Theory and Performance Evaluation*, Springer-Verlag, 3rd ed., 2000, xiii, 409 pp. (ISBN 0-387-95037-0).

- Required Course Materials:

5565: Supplemental journal and conference papers, Internet Engineering Task Force (IETF) Request for Comment (RFC) documents, and other supplemental readings may be used to introduce the latest developments and to provide more detailed documentation for projects.

5566: Supplemental journal and conference papers, Internet Engineering Task Force (IETF) Request for Comment (RFC) documents, and other supplemental readings may be used to introduce the latest developments and to provide more detailed documentation for projects. Access to network simulation software, such as IT Decision Guru or Modeler from OPNET Technologies (currently available for educational use).

**PART VI. Syllabus**

5565:

	Percent of Course
Basic Definitions and Layered Protocol Models	5%
Direct Link Networks - Ethernet, FDDI	15%
Packet and Cell Switching - Routing, ATM	20%
Internetworking - IP, Multicast	10%
End-to-End Protocols - UDP, TCP, RPC	15%
End-to-End Data	5%
Congestion Control	15%
High-Speed Networking	15%
	<hr/> 100%

5566:

	Percent of Course
Approaches and metrics for evaluation; synergies among evaluation, design and management	5%
Queuing theory, M/M/1, M/M/1/K, M/M/m, M/M/∞, M/M/m/m, M/G/1 and M/G/1 with priority models	15%
Open and closed networks of queues	5%
Discrete-time queuing systems	5%
Simulation models for network and protocol design and performance analysis	15%
Traffic characterization and modeling; self-similarity	10%
Network bandwidth assignment and bandwidth management	10%
Graph theory and application to access and backbone network design	20%
Network Management and SNMP	15%
	<hr/> 100%

**PART VII.** Old (Current) Syllabus

N/A

**PART VIII.** Core Curriculum

N/A

**PART IX.** Design Justification

N/A

**4 April 2002**

**TO: CoE Curriculum Committee**

**SUBJECT: ECE/CS 5565-5566 Course Proposal**

**FROM: ECE, Dr. Nathaniel J. Davis IV, Assistant Head**

1. The information content in the course sequence ECE/CS 5515, 5516 has diverged in the last 5-10 years and both departments feel that the presentation of the course content as a 2-semester sequence is no longer appropriate. The content of 5516 along with information that has been taught for several years in 5984 sections is being moved to a new sequence, ECE/CS 5565-5566. 5515 is being addressed in another course proposal.
2. When the course proposal for ECE/CS 5565-5566 is approved, 5565 will directly replace the existing 5516, which will be deleted. 5566 will replace the previous offering of the 5984s. Thus, there will be no change in the resource requirements.
3. The CS Department is forwarding an identical copy of the 5565-5566 proposal through their college for approval.



March 13, 2002

TO: Course Approval Committees

FROM: Verna Schuetz   
Associate Department Head

RE: ECE/CS 5565-5566

The Computer Science Department supports the Electrical and Computer Engineering Department's proposal for ECE 5565-5566, which will be cross-listed as CS 5565-5566. We understand that if ECE ceases to teach the course, a new course proposal will need to be submitted before the course can be offered again.

## Duncan, Angela

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From: Avery, Roger  
Sent: Friday, October 25, 2002 2:09 PM  
To: Duncan, Angela  
Subject: FW: Tabled ECE/CS 5565,66

Angela,

For GCC meeting.

R

-----Original Message-----

From: Nat Davis [mailto:ndavis@vt.edu]  
Sent: Friday, October 25, 2002 2:01 PM  
To: Avery, Roger  
Cc: Adel, Gregory; Midkiff, Scott; Schuetz, Verna; Gray, Festus; Abbott, Amos  
Subject: Tabled ECE/CS 5565,66

Roger,

Per our phone call a few minutes ago, I am sending this email to provide additional information concerning the ECE/CS 5565,66 course proposal and to request that the proposal be approved at the next Graduate Curriculum Committee meeting.

ECE/CS 5565,66 has a prerequisite requirement of STAT 4714, Probability and Statistics for Electrical Engineers. When the Graduate Curriculum Committee met yesterday, the course proposal was tabled pending receipt of a letter of support for the course from the Statistics Department. I feel that this coordination is not necessary and the course should be approved. My reasoning is outlined below.

STAT 4714 is a required course for all undergraduate students in EE, CPE, and CS. Probability and statistics courses are more or less "required" for all undergraduate students in these disciplines -- regardless of their school. Each year, literally hundreds of EE, CPE, and CS undergraduate students take STAT 4714 at Virginia Tech (241 are enrolled in it this semester and "seats" for 370 are available for the Spring 03 term).

In the unlikely event that an ECE or CS graduate student came to Virginia Tech without a probability and statistics course in their background, they might be expected to take STAT 4714 here. In any given year, I can not imagine more than a handful of EE, CPE, or CS graduate students needing to take STAT 4714. These few will not impact the teaching load for 4714 given the hundreds of undergraduates that will be in the course anyway. Thus, approval of ECE 5565,66 with the STAT 4714 prerequisite will not increase the teaching load of the Statistics Department in any significant way. To the best of my knowledge, the Statistics Department did not object to the ECE 5565,66 course proposal when it went out for 15-day review.

Please reconsider the tabling of ECE/CS 5565,66 and approve the course sequence.

Thank you,

Nat

Dr. Nathaniel J. Davis IV  
Professor and Assistant Department Head -EE