

Southern Polytechnic State University
Electrical & Computer Engineering Technology

ECET 4840
Advanced Telecommunications

Spring Semester 2008

Dr. Austin B. Asgill

**School of Engineering Technology
and Management**

Southern Polytechnic State University
Electrical & Computer Engineering Technology
ECET 4840 - Advanced Telecommunications
Spring Semester 2008

Instructor: Dr. Austin B. Asgill, Assoc. Prof. ECET
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Class Time: 06:00 pm - 08:30 pm T
Lab Time: 08:40 pm - 11:00 pm T

Room: G-176
Room: G-219

Credits and Contact Hours: 3-3-4

2007-2008 Catalog Description:

A study investigating several advanced telecommunications technologies and techniques. Course covers such topics as: data transmission principles, time and frequency domain concepts, Fourier signal analysis, transmission impairments (delay distortion, noise), channel capacity, sampling and quantization, routing and switching theory, routing algorithms and protocols, high-speed networking technologies, queuing theory, congestion control mechanisms, mobile and residential broadband systems, wireless technologies, network security techniques and implementation, and emerging technologies (IPv6, 3G and 4G networks).

Prerequisites: ECET 2210, ECET 2800, ECET 4820

Required or Elective: Required

Course Website:

http://www.spsu.edu/ecet/aasgill/ECET4840/ECET4840_ASG_Spring2008.html

Textbook: William Stallings, *Data & Computer Communications*, Prentice-Hall, 8th ed., 2006.

- Reference(s):**
- (1) Youlu Zheng, Shakil Akhtar, *Networks for Computer Scientists and Engineers*, Oxford University Press, 2002.
 - (2) Douglas E. Comer, *Computer Networks and Internets - with Internet Applications*, Prentice-Hall, third edition, 2001.

Course Objectives:

Upon successful completion of this course, students will be able to do the following:

1. Demonstrate a fundamental understanding of data transmission principles: Time and Frequency domain concepts, Fourier signal analysis, Data rate and bandwidth relationship, Transmission impairments (delay distortion, noise), Channel capacity, Sampling and quantization (TAC/ABET: a, b, c, f; ECET outcomes: 1, 2, 3, 4).

2. Understand routing and switching theory and routing algorithms and protocols (TAC/ABET: a, b, d, f, ; ECET outcomes: 1, 2, 4).
3. Demonstrate an understanding of queueing theory as applied to data systems (TAC/ABET: a, b, d, f; ECET outcomes: 1, 2, 4).
4. Demonstrate an understanding of the principles of network analysis and be able to conduct analysis of data traffic utilizing packages such as Ethereal (TAC/ABET: a, b, c, f; ECET outcomes: 1, 2, 3, 4).
5. Demonstrate an understanding data network congestion control mechanisms (TAC/ABET: a, b, c, f; ECET outcomes: 1, 2, 3, 4).
6. Demonstrate a fundamental understanding of high speed networking technologies: DSL, Cable Modems, Fast and Gigabit Ethernet (TAC/ABET: a, b, f; ECET outcomes: 1, 2, 4).
7. Demonstrate an understanding of ATM switching protocols and virtual LANs, SONET/SDH and DWDM systems (TAC/ABET: a, b, f; ECET outcomes: 1, 2, 4).
8. Demonstrate a fundamental understanding of mobile, residential, and broadband systems (including HDTV) (TAC/ABET: a, b, d, f; ECET outcomes: 1, 2, 4).
9. Demonstrate a fundamental understanding Network Security techniques and implementation (TAC/ABET: a, b, c, d, f, h; ECET outcomes: 1, 2, 3, 4).
10. Demonstrate an understanding of distributed Internet applications (TAC/ABET: a, b, d, f; ECET outcomes: 1, 2, 4).
11. Be able to articulate emerging concepts and technologies such as IPv6, 3G and 4G networks (TAC/ABET: a, b, d, f, g, h, k; ECET outcomes: 1, 2, 4, 8).

Computer Usage:

Some course assignments will require programming in a high level language or the use of simulation software such as OPNET, SystemView, Mathcad or Matlab.

Assessment and policies to meet TAC/ABET criteria a- k and program outcomes:

Homework:

Homework is assigned to provide students with the opportunity to work through and apply new concepts on their own. It also provides practice in documentation. The assignments are usually related to the topics covered , and serves to reinforce the learning of the material. The deadline for submission of homework is provided well in advance, and students are penalized for turning in late homework. Timely feedback is important for the student and for the instructor. The overall homework grade is combined with the grades for pop quizzes and makes up 5% of the course grade. This serves to underscore the importance of the homework in learning the course material and underscores the importance of accountability and timeliness in engineering (TAC/ABET: a, b, d, f, g, k; ECET outcomes: 1, 2, 4, 8).

Pop Quizzes/Attendance:

In order to emphasize the importance of timeliness and continuous improvement, pop quizzes are administered from time to time at the beginning of the class period. Failure to be punctual

results in no score for the particular pop quiz. Attendance is also monitored and used as a measure of quality, and timeliness. Pop quizzes and attendance in conjunction with homework constitute 5% of the course grade (TAC/ABET: a, b, f, g; ECET outcomes: 1, 2, 4, 8).

Exams:

The purpose of exams is to test the comprehension of concepts covered in class. There are usually three hourly exams that make up 50% of the course grade. The final exam is comprehensive and is a two hour exam that makes up 15% of the course grade.

Except for the final exam, exam questions provide an opportunity for further discussion of the course material when the graded exams are returned (TAC/ABET: a, b, d, f, g, k; ECET outcomes: 1, 2, 4, 8).

Term Project/Paper:

Students are required to write a term project/paper detailing some aspect of the state of modern telecommunications practice. The term project/paper serves to provide an avenue for the student to research the latest techniques and technologies applicable to the field, and to document their findings in a written report. In addition to the written report, each student is required to give an oral presentation of their report. The term project/paper constitutes 10% of the course grade (TAC/ABET: a, d, f, g, h, i, j, k; ECET outcomes: 1, 2, 4, 5, 7, 8).

Laboratory Experiments and Report Writing:

The laboratory/project component is an essential part of Advanced Telecommunications for the TCET program. The Laboratory exercises are a combination of experiments utilizing telecommunications network equipment, network analyzers, and simulation software such as OPNET and SystemView. Each laboratory exercise requires a written report. The ability to report technical information in a clear and concise manner is one of the most important skills that a technically trained individual can develop. Students are organized into teams and are encouraged to develop their reports through team work. The students are required to follow a certain format for their reports. Adherence to the format helps to ensure that the information presented is complete and well organized. The overall laboratory grade makes up 20% of the course grade. Students must pass the laboratory portion of the course to get a passing grade for the course (TAC/ABET: a, c, d, f, g, k; ECET outcomes: 1, 2, 3, 4, 5, 6, 8).

ECET 4840 Advanced Telecommunications Syllabus

<u>Class Period</u>	<u>Topics</u>	<u>References/Notes</u>
1/15	Introduction	
1/22	Fourier Analysis Noise/Shannon's Equation	
1/29	Sampling, Quantization Sampling, Quantization Routing/Switching Theory	
2/05	EXAM I Routing Algorithms/Protocols	
2/12	Queueing Theory Network Analysis	
2/19	Network Analysis Network Analysis	
2/26	Congestion Control Mechanisms Congestion Control Mechanisms	
3/04	No Class - Spring Break	
3/11	EXAM 2 Internet Protocol version 6 (IPv6) High Speed Networking Technologies - ISDN, DSL and Cable Modems	
3/18	High Speed Networking Technologies - Fast Ethernet, Gigabit Ethernet, 100VG-AnyLan ATM Switching and Virtual LANs	
3/25	SONET/SDH & DWDM Mobile Broadband Systems	
4/01	Mobile Broadband Systems Mobile Broadband Systems	
4/08	EXAM 3 Network Security	
4/15	Network Security Network Security/Emerging Technologies	
4/22	Emerging Technologies Review	
4/29	Review, Last Day of Classes	
5/03 - 5/08	Final Exams	

Note: Exam dates may be changed. Any such changes will be announced in class prior to the exam date.

Course Requirements:

Attendance: Attendance must be regular and punctual. Any more than three un-excused absences will result in automatic withdrawal from the course. The student is responsible for any class notes missed due to absence.

Homework/Exams:

Specifications:

- All homework and exams (except computer printouts) must be done on **"Engineering" grade paper only**.
- **All work must be shown in a neat and orderly manner, with answers clearly marked.** All relevant diagrams must also be shown (**neatly**) with clear labeling. Solutions must be legible and clearly presented in a logical manner so that partial credit, where applicable, can be awarded. The final answer must be clearly identified.
- Begin each homework or examination problem on a separate sheet of paper, except where two or more very short solutions may fit on the same sheet.
- **Put your name, due date and assignment number on each sheet**, and staple the answer sheets together in the upper left hand corner.
- *Any evidence of copied homework or examinations will result in both parties involved receiving an 'F' or '0' grade for that homework/exam.*

Exams: There will be three (3) exams during this course and a final exam. Exams will be on the material covered in class prior to the exam time except for the **final which will be comprehensive. No "make-up" exams will be given except in extremely extenuating circumstances.**

Pop Quizzes: Unannounced quizzes will be given as needed during the first ten (10) minutes of class. Questions can only be picked up during this ten minute period. Punctuality is therefore essential.

Project/Paper:

Students will be required to develop a research project and write a paper outlining some aspect of modern telecommunications. The project/paper may take the form of a real-world telecommunication network case study, a demonstrable applied research project, or a research paper on a current aspect of telecommunications technology. The project/paper must demonstrate an understanding of the applications of the course material to the project outlined.

Grading:

If Final exam score < Exam average

Exams = 45%, Finals = 15%, Labs = 20%, Project/Paper = 10%, Homework/Pop Quizzes = 10%

If Final exam score is \geq Exam average

Exams = 35%, Finals = 25%, Labs = 20%, Project/Paper = 10%, Homework/Pop Quizzes = 10%

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Time: 08:40 pm - 11:00 pm T

Room: G-219

Textbook: None.

Parts Kits: None Required

Attendance: On-time attendance is expected.

Grading: There are nine laboratory exercises. Students will work in groups on each exercise. A formal report will be required for one experiment to be determined. The formal lab is weighted three times as much as the other laboratory exercises. All of the other labs carry the same weight.

Unless otherwise specified, laboratory exercises will be due by the beginning of the following laboratory period.

All pre-lab requirements must be completed prior to attending the lab. Lab reports are to be jointly developed by group members. It is the responsibility of each member of the group to ensure that reports are completed and turned in on time.

Plagiarism will not be tolerated and will result in a *failing grade* for the lab.

You must pass the lab portion of ECET 4840 to pass the course.

PREPARED BY: Dr. Austin B. Asgill

DATE: Spring 2008