

<p><b>Course SYLLABUS</b></p>	<p>รายละเอียดและตารางสอนสำหรับนักศึกษาปริญญาโท <b>วศ.ม.สารสนเทศ</b>  <b>วิชา 01237116 Channel Coding Theory</b>  Semester 2/2005 (1 November 05 – 26 February 06) Time: Sat. 11-12 am  Room: DSL room E12-1106  11<sup>th</sup> floor / 12 floor building  Faculty of Engineering, KMITL  <a href="http://www.kmitl.ac.th/dslabs">www.kmitl.ac.th/dslabs</a></p>
<p><b>Goal</b></p>	<ul style="list-style-type: none"> <li>● Error Control Coding: concept and applications for data storage systems, wire-line and wireless communications, digital video broadcasting, satellite communications, space exploring systems, and the implementation technologies.</li> <li>● Perspective in RS, Reed-Solomon, BCH, Convolution, TCM, Turbo, and LDPC Codes</li> <li>● Documentary &amp; Research skill building</li> <li>● Result to the proposal for various application research topics</li> </ul>

Lecturers:

Assoc. Ornlarb Sangaroon

(วศ. อรลภม แสงอรุณ)

and

Dr. Keattisak Sripimanwat

National Electronics & Computer Technology Center (NECTEC)

ดร.เกียรติศักดิ์ ศรีพิมานวัฒน์ (อาจารย์พิเศษ)

ศูนย์เทคโนโลยีอิเล็กทรอนิกส์และคอมพิวเตอร์แห่งชาติ

Required text:

# Digital Communications *Fundamentals and Applications*, Sklar, 1988 or 2001

# Communication Systems, *Simon Haykin*, 3<sup>rd</sup> edition, or 4<sup>th</sup> edition (2002)

Recommended text:

# Error-Correcting Coding Theory, *Man Young Khee*, McGraw-Hill, 1989

# Error Control Coding: Fundamentals and Applications, *Lin and Costello*, Prentice-Hall

# Digital Modulation and Coding, *Stephen G. Wilson*, Prentice-Hall, 1996

# <http://www.kmitl.ac.th/dslabs/TurboCodes/>

\* Details and announcement will be posted weekly on the web <http://www.kmitl.ac.th/dslabs/>

**Exams and assignments:**

- There will be one midterm exam.
- There will be two assignments with homework; one survey report before midterm and another software assignment before final exam.
- First assignment focuses on literature review, product & applications and related patent survey. The detail and contents of this assignment will be discussed in the class. To gain research experience, students would be guided to conduct his/her own small research project bases on the utilization of error control coding in specific communication channel. The final assignment is a report that covers the improved midterm report version, demonstration of an assigned software research project, and final conclusion. Individual topic, concerned templates, and materials would be discussed in the class.

**Attendance Policy**

Students are expected to attend every classes during the semester (will not be allowed to take the final exam if **miss more than four classes**). To sign on class attendance sheet during class hours!

Grading:	First assignment	20%
	Midterm exam (open book exam)	20%
	Final assignment	40%
	Class attendance and homework	20%

**Note:**

This class is set up for those who intend to start his/her full time research by having time study this course “full time”. The goal of course is to apply both technical aspect of error control coding and also research methodology for future master research / thesis. Thus, it is noted to all *part time* students who intend to enroll this course to consider this syllabus carefully in detail. Certainly, he/she **MUST** put much of effort during study. This course is confirmed opened in case of any number of enrolled students.

**Course schedule:**

Students are expected to prepare reading prior the class as listed below.

1 November 05 – 26 February 06

Date	Topic	Reading (before class)
Nov. 5, 2005	Course Introduction and Background test <b>Homework: <i>Milestone &amp; History</i></b>	Principle of Digital Communications & Error control Coding

Nov. 12, 2005	- Investigation on Error Control Coding Concept & Applications <b>First Assignment : Topics</b>	Block Codes Concept
Nov. 19, 2005	- Principle and applications of RS, BCH, Reed- Solomon Codes <b>Homework:</b>	Concept of RS, BCH, Reed- Solomon Codes
Nov. 26, 2005	- Introduction to Convolution Codes and its applications <b>Homework:</b>	Principle of Convolution Codes
Dec. 3, 2005	<i>Long Holiday</i>	
Dec. 10, 2005	<i>Long Holiday: Assignment (draft)</i> submission	
Dec. 17, 2005	- <b>Tutorial class:</b> Soft & Hardware Implementations - <b>Comment</b> on the first assignment report	
Dec. 24, 2005	- Research in Classical Channel Coding - Assignment Submission (hard copy and file) - Conclusion for midterm exam	
Dec. 31, 2005	<i>Long Holiday</i>	
Jan. 7, 2006	<b>Midterm Exam (open book)</b>	
Jan. 14, 2006	- <b>Comment</b> on assignment and midterm exam - Trellis Coded Modulations (TCM) <b>Homework:</b>	Principle of Trellis Coded Modulations (TCM)
Jan. 21, 2006	Turbo Codes I	
Jan. 28, 2006	<b>Tutorial class:</b> Related Soft & Hardware Implementations	
Feb. 4, 2006	Turbo Codes II <b>Homework:</b>	
Feb. 11, 2006	<b>Tutorial class:</b> Contemporary ECC Researches	
Feb. 18, 2006	LDPC and Present ECC Development	
Feb. 25, 2006	<b>Final Class / Final Report Discussion</b>	

\* Final report submission will be scheduled in the class, cancel and/or make up class will be notified.

## Technical Outline:

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### Part I Principles

*Course introduction: Channel coding and its potential*

*Basic Error Control Coding Schemes*

*Concerned Mathematics*

*Communication Channel: Conditions & Modeling*

### Part II Concepts

Cyclic codes

BCH and Reed-Solomon codes

Convolutional codes

Decoding convolutional codes: Viterbi algorithm and others

Trellis coded modulation (TCM)

Concatenated Codes

Turbo codes / LDPC Codes

### Part III Applications

Data Storage: *CD VCD DVD*

Land Line Communications: *Modem & xDSL Modem*

Wireless Communications: *3G Mobile communications, WiFi, WiMAX, MIMO / Space time coding*

Satellite Communications: *e.g. IP-Star, digital video broadcasting (DVB), etc*

Deep Space Communications: *Cases of NASA / ESA (European Space Agency) mission to Mars, etc.*

Others: *HDTV, Fault Detection*