

# **King Fahd University of Petroleum & Minerals Computer Engineering Dept**

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**COE 543 – Mobile and Wireless  
Networks**

**Term 032**

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## **Objectives**

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- To model and evaluate the performance of an assumed wireless network
  - To gain a deep understanding of the details of a given wireless protocol
  - To be able to make reasonable assumptions and facilitate network modeling
  - To construct a simulation model that will enable testing/validation of the network
  - To be able to verify/validate your work against known literature results, if any
  
- Literature survey-based project will not be acceptable

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## Tools/Means

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- Opnet
- NS
- Matlab
- C/C++
- Any other tool

## List of Projects (1)

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No.	Topic
1	Voice capacity for 1xRTT cdma2000
2	Modeling and simulation of slotted ALOHA
3	Modeling and simulation of DCF in IEEE802.11
4	Modeling and simulation of RTS/CTS in IEEE802.11
5	Modeling and simulation of PCF in IEEE802.11
6	Modeling and simulation of Nonpersistent CSMA
7	Modeling of Wireless Signal Envelope and Evaluation of Diversity Techniques Gains
8	GPRS Capacity Evaluation

## List of Projects (2)

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No.	Topic
9	Performance Evaluation of Routing Algorithms for Ad-Hoc Networks
10	Design and Performance Evaluation for Turbo Codes
11	Bluetooth Technology
12	Internet Traffic Modeling
13	Wireless TCP

Other reasonable proposals not listed above are also acceptable. Those should be submitted for approval by Tuesday March 8<sup>th</sup>, 2003.

## List of Projects – Physical Layer

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- Modeling of Wireless Signal Envelope and Evaluation of Gains for different Diversity Techniques:
  - Switching
  - Selection
  - Maximum ratio combining
- Analytical results are readily available in literature
- Refer to any textbook in mobile communications
- Output:
  - Gain versus number of branches – for different scheme
  - Showing diminishing return phenomenon
  - Etc.

## List of Projects – Physical Layer

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- Design and Performance Evaluation for Turbo Codes:
- Simulation results are readily available in literature for different encoder-decoder parameters
- Matlab or C/C++ may be the best tool for this project
- Output:
  - BER versus  $E_b/N_0$
  - Gains versus delay/complexity
  - Relative comparison with other coding techniques (convolutional, etc.)

## List of Projects – Access Techniques

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- Modeling and simulation of slotted ALOHA
- Analytical results are readily available in literature
- Opnet/NS may be the best for this project
- Output:
  - # of terminals versus throughput curves (for different probability of generating traffic)
  - # of terminals versus delay curves
  - Delay versus backoff parameter
  - Etc.

## List of Projects – Access Techniques

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- Modeling and simulation of CSMA
- Analytical results are readily available in literature
- Variations: Slotted/Non-slotted Nonpersistent, Slotted/Non-slotted 1-persistent, p-persistent\*
- Opnet/NS may be the best for this project
- Output:
  - # of terminals versus throughput curves (for different probability of generating traffic)
  - # of terminals versus delay curves
  - Delay versus backoff parameter
  - Etc.

only one variation is required per team

## List of Projects – Access Techniques

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- Modeling and simulation of IEEE802.11
- Student is required to find reference results in literature and compare to simulation results
- Variations: DCF, RTS/CTS, and PCF (and/or any combination)
- Opnet/NS may be the best for this project
- Output:
  - # of terminals versus throughput curves (for different probability of generating traffic)
  - # of terminals versus delay curves
  - Delay versus IFS/backoff parameter
  - Etc.

only one variation is required per team

## List of Projects – Wide Area Networks

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- Voice Capacity Evaluation for 1xRTT cdma2000
- Student is required to find reference results in literature and compare with simulation results
- Output:
  - Blocking probability versus offered load (# of subs)
  - Effect of Eb/No threshold
  - Call drop rate
  - Interference statistics
  - Etc.

## List of Projects – Wide Area Networks

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- Capacity Evaluation of GPRS
- Student is required to find reference results in literature and compare with simulation results
- Output:
  - b/s per carrier?
  - Interference statistics
  - Etc.

## List of Projects – Wide Area Networks

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- Wireless TCP or TCP Performance Over Wireless Links
- Student is required to characterize of the slow-start problem and the performance of TCP over wireless links
- Reference results in literature are available - Compare with simulation results – or reproduce results of a respectable paper in the area
- Output:
  - Throughput versus error rate curves
  - Window sizes versus throughput for different error rates
  - Etc.

## List of Projects – Ad-Hoc Networks

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- Performance Evaluation of Ad-Hoc Networks Routing Algorithm(s)
- For one routing algorithm and a specific scenario, write a code to simulate and evaluate the algorithm
  - Report performance and potential enhancements
- Deliverable:
  - Report- including the source/binary code
  - Presentation
- Where to start:
  - E. Royer, S. Barbra, C. Toh, "A review of Current Routing Protocols for Ad-Hoc Wireless Mobile Networks," IEEE Personal Communications, April 1999, pp. 46-59.

## List of Projects – Local/Personal Area Networks

- Characterization of Performance for a Simplified Bluetooth Network Setup
- Specify the wireless MAC used and its specs and write a code to simulate and evaluate a simple network under different load conditions
- Report performance and compare against other simulation results
- Deliverable:
  - Report- including the source/binary code
  - Presentation
- Where to start:
  - K. V. S. Sairam, N. Gunasekaran, S. Rama Reddy, "Bluetooth in Wireless Communication," IEEE Communications Magazine, June 2002, pp. 90-96.

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## Time Line

- Monday March 1<sup>th</sup>, 2004: Introduction of Projects
- Monday March 8<sup>th</sup>, 2004: Team/Project Assignment Finalized
- Saturday April 10<sup>th</sup>, 2004: Preliminary report/code
  - Sections of the report/presentation identifies
  - Simulation tool and method identified
  - Skeleton code designed
  - Reference results from literature identified for comparison or reproduction
  - Weight 10%
- Sunday May 17<sup>th</sup>, 2004
  - Final report/code
  - Final presentation material
  - Weight 5%
- Sunday May 22<sup>th</sup>, 2004: Start of Presentations and Evaluation
  - Weight 10%

10% +

5% +

10%

→ 25%

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## Deliverables

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- All teams will be responsible for delivering:
  - Final report - MSword or Framemaker - by email
  - Final presentation material – powerpoint – by email
  - CD containing simulation code and results in addition to all of the above

before the final presentations date on May 22<sup>nd</sup>

- Students should deliver a soft and a hard copy of their project
- Soft and hardcopies of intermediate reports and draft presentations should also be delivered on the specified due dates

## Choosing a Project

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- Please think thoroughly and consider your background and programming skills when you make your choice
- Once you make your choice, please send it by email
- The list of available projects will be updated as preferences are received
- Teams can be of 1 or 2 students at most – however, teams of 2 students are expected to deliver twice as much work compared to teams comprising of 1 student each.