



# EQ2860 Teoretiska grunder för trådlös kommunikation 7,5 hp

Theoretical Foundations of Wireless Communications

När kurs inte längre ges har student möjlighet att examineras under ytterligare två läsår.

## Fastställande

Kursplan för EQ2860 gäller från och med VT19

## Betygsskala

A, B, C, D, E, FX, F

## Utbildningsnivå

Avancerad nivå

## Huvudområden

Elektroteknik

## Särskild behörighet

Knowledge and maturity in the field, corresponding to EQ2310 Digital Communications and EQ2410 Advanced Digital Communications.

## Undervisningsspråk

Undervisningsspråk anges i kurstillfällesinformationen i kurs- och programkatalogen.

# Lärandemål

To pass this course the student needs to be able to:

- Identify and describe the fundamental limitations of using the wireless medium for communications, in terms of such objective analytical measures as channel capacity, outage probability, error probability, degrees of freedom, diversity, power efficiency and bandwidth efficiency.
- Identify and describe the different physical phenomena that limit the possible performance of wireless communications.
- Identify and describe modern techniques for high-rate wireless communications, including MIMO transmission, scheduling, multiuser coordination, power allocation, and rate allocation.
- Use and formulate mathematical models for analysis and synthesis of single and multiuser communication links over wireless channels.
- Solve mathematically oriented problems resulting from asking questions about achievable performance and limits of wireless communications.

To qualify for a higher grade a student who has passed the course needs in addition to be able to:

- Utilize such objective analytical measures as channel capacity, outage probability, error probability, degrees of freedom, diversity, power efficiency and bandwidth efficiency, to compare different techniques and scenarios.
- Derive, formulate and use advanced mathematical models for analysis and synthesis of single and multiuser communication links over wireless channels.
- Solve advanced mathematically oriented problems resulting from asking questions about achievable performance and limits of wireless communications.

# Kursinnehåll

The focus is on the **theoretical foundations of digital communications over wireless channels**, with material building on fundamental principles from information theory, communication theory, detection and estimation, and signal processing. A brief outline of the course contents is as follows.

- Capacity of wireless channels
- Multiuser capacity and opportunistic communication
- MIMO I: spatial multiplexing and channel modeling
- MIMO II: capacity and multiplexing architectures
- MIMO III: diversity-multiplexing tradeoff and universal space-time codes
- MIMO IV: multiuser communication

The three main topics are 1) channel capacity and information theory for wireless communications; 2) multiple-input multiple-output (MIMO) transmission; 3) multi-user scenarios

# Kurslitteratur

David Tse and Pramod Viswanath “Fundamentals of Wireless Communication”

## Examination

- TEN1 - Tentamen, 7,5 hp, betygsskala: A, B, C, D, E, FX, F

Examinator beslutar, baserat på rekommendation från KTH:s handläggare av stöd till studenter med funktionsnedsättning, om eventuell anpassad examination för studenter med dokumenterad, varaktig funktionsnedsättning.

Examinator får medge annan examinationsform vid omexamination av enstaka studenter.

## Övriga krav för slutbetyg

Mandatory homework problems. Written exam.

## Etiskt förhållningssätt

- Vid grupparbete har alla i gruppen ansvar för gruppens arbete.
- Vid examination ska varje student ärligt redovisa hjälp som erhållits och källor som använts.
- Vid muntlig examination ska varje student kunna redogöra för hela uppgiften och hela lösningen.