

# University of Pretoria Yearbook 2021

## Stochastic communications systems 320 (ESC 320)

<b>Qualification</b>	Undergraduate
<b>Faculty</b>	<a href="#">Faculty of Engineering, Built Environment and Information Technology</a>
<b>Module credits</b>	16.00
<b>NQF Level</b>	07
<b>Programmes</b>	<a href="#">BEng Electronic Engineering</a> <a href="#">BEng Electronic Engineering ENGAGE</a>
<b>Prerequisites</b>	WTW 258, WTW 256, WTW 238 and EMS 310 GS
<b>Contact time</b>	1 practical per week, 1 tutorial per week, 3 lectures per week
<b>Language of tuition</b>	Module is presented in English
<b>Department</b>	Electrical, Electronic and Computer Engineering
<b>Period of presentation</b>	Semester 2

### Module content

Review of signal theory. Introduction to probability theory (probability, random variables, statistical averages, correlation, sums of random variables, and the central limit theorem), random processes (RPs) and spectral analysis (ensemble statistics, classes of RPs, power spectral density, multiple RPs, transmission of RPs through linear systems, Wiener-Hopf filtering, signal-to-noise ratios (SNRs), optimal pre/de-emphasis, and bandpass RPs). Performance characterisation of digital communication systems (optimal linear detection, matched filtering, signal detection, bit error probability, coherent receivers, optimal detection in the signal space, vector representations of RPs, optimal receivers in additive white Gaussian noise (AWGN) channels, M-ary digital modulation performance analysis, and equivalent signal sets). Spread spectrum communications (frequency-hopping spread spectrum (FHSS), direct-sequence spread spectrum (DSSS), code-division multiple access (CDMA), multiuser detection, and practical spread-spectrum systems). Linear distortive channel communication (equalisation, channel estimation, and orthogonal frequency-division multiplexing (OFDM)). Introduction to information theory (entropy, source coding, error-free communication, channel capacity in discrete and continuous memoryless channels, and frequency-selective channel capacity). Error correcting codes (redundancy, linear block codes, cyclic codes, convolutional codes, and trellis diagrams). The focus will be on applications in the cellular and mobile communication fields where stochastic processes such as noise and channel effects are of prime importance.

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