

# Thematic Topics for the Master Final State Exam

## Master study program Communication, Multimedia and Electronics

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### Common Theoretical Part

1. Probability, independent events, Bayes' formula, random variable, distribution function, quantile function, moments, transformations of random variables, random vector. (A2M01PMS)
2. Covariance, correlation. Chebyshev's inequality, law of large numbers, central limit theorem. (A2M01PMS)
3. Random sampling, statistics, point and interval estimates, tests of hypotheses, testing of goodness of fit. (A2M01PMS)
4. Linear and cyclic convolution, signal segmentation and synthesis, properties of DFT, windowing, consequences of quantization. (AE2M99CZS)
5. Resampling, filter banks, estimation of random signal characteristics, spectral and correlation analysis, signal modelling and linear prediction. (AE2M99CZS)
6. Computer architectures (Von Neumann, Harvard). Memories, busses. Address and I/O space of the processor, run-time reconfiguration. On-chip peripherals, I/O space extension. Instrument and communication busses, multiprocessor communication. (AE2M99MAM)
7. Processor programming, machine code, assembly language, high-level languages, interrupt system, pipeline. Programming techniques, multiprocessor systems, parallel programming. (AE2M99MAM)
8. Properties of digital modulations. Input/Output model of communication channel, likelihood function. Demodulator, metrics (correlation, signal space, SODEM) Communication channel sharing. (A2M37DKM)
9. Block and convolution codes, matrix description, properties. Coding in constellation space. Viterbi algorithm. Space-Time Coding, turbo codes and LDPC principles. Detection error rate. (A2M37DKM)
10. Architecture of wireless networks, mobile networks, frequency planning, allocation of radio resources, radio access methods, optimization of data transmissions at physical and data link layer, handover, power control. (A2M32MKS)
11. Mesh and Ad-hoc networks, generation of mobile networks, WLAN and WMAN, convergence of wired and wireless networks. (A2M32MKS)
12. Analogue and Digital integrated systems design methodology. IC manufacturing process; CMOS technology, IC technology trends, IC layout and design rules. (AE2M34SIS)
13. MEMS technology; polymer technologies, optoelectronic integrated circuits and systems - technology process, design and properties of optoelectronic ICs. (AE2M34SIS)
14. Parameters of antennas, antenna types - line, loop, slot, micro strip. Horn, reflector antennas, lenses, wideband antennas, antenna arrays. Measurement of antennas. (A2M17AEK)
15. Electromagnetic interference, jamming, types of coupling, anti-jamming elements. Electromagnetic screening, Electromagnetic resistance. Hygienic standards. (A2M17AEK)

### Thematic Areas

#### Branch Electronic Communication Networks

1. Switching system, switching equipment - switching field, subscriber sets, switching line, trunks, tone generators, diagnostics, control of digital switching system. (A2M32RKP)
2. Numbering plan of telecommunication networks, signalling in switching systems, CAS, CCS. (A2M32RKP)
3. SS7 signalling - message routing, SCCP, TCAP, ISUP MAP protocols. (A2M32RKP)
4. Intelligent networks, IP telephony, quality and its provisioning and assessment, IMS systems, H.323, SIP/SDP signalling protocols, RTP/RTCP communication protocol. (A2M32RKP)
5. Telecommunication network, optimization of topology, dependability (availability and reliability) of network, forecasting methods, evaluation of quality of service (QoS) and its parameters, quality service

control models in IP networks, classification, traffic marking and characteristics of data flows. (A2M32MDS)

6. Parameters of service system, application of queuing theory on dimensioning of service systems, traffic flow and its mathematical representation, influence of traffic nature on grade of service (GOS) of service system. (A2M32MDS)
7. Outcomes of the theory of loss and waiting service systems for real applications, priority service systems - practical employment in packet networks, modelling and simulation of service system, confidence interval as accuracy measure of results. (A2M32MDS)
8. Optical properties of fibres, attenuation windows, nonlinear scattering, polarization mode dispersion and its suppression, chromatic dispersion compensation. (A2M32OSS)
9. Optical amplifiers (Raman, EDFA, SOA), wavelength convertors and optical signal regeneration (1R, 2R, 3R), optical filters, optical switches and their application. (A2M32OSS)
10. Optical DWDM and CWDM systems (attenuation, noise and dispersion line balance) optical networks, network elements, optical interfaces (Ethernet, SDH, OTH, PON). (A2M32OSS)
11. Digital signal processing in the communication chain, advanced design of finite and infinite impulse response filters. (A2M32VAD)
12. Digital image (and video) processing, design of 2-D and n-D filters, image and video filtering, adaptive filtering. (A2M32VAD)
13. Architecture of digital signal processors, functional units, CPU, registers, instruction set. (A2M32VAD)
14. Digitalization of speech signals, spectral characteristics, vocoders used in telecommunications, subjective and objective measurement of speech quality. (AE2M31RAT)
15. Packet loss concealment after the transmission over communication channel, suppression of noise in speech signal, echo cancellation. (AE2M31RAT)
16. Principles and realization of speech recognition, speech synthesis, dialog communication systems. (AE2M31RAT)