

# Thematic Topics for the Bachelor Final State Exam

## Bachelor study program Communication, Multimedia and Electronics

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### Common Theoretical Part

1. Limit and derivation of a function, Taylor series, behaviour of functions, integration of functions. Definite integral, applications. Improper integral. Differential equations. Convergence of series. (A2B01ZMA)
2. Systems of linear equations, linear spaces. Linear mappings and their matrices. Matrices and determinants. Scalar product. Eigenvalues and eigenvectors. Laplace transform. (A2B01LAA)
3. Functions of more variables. Limit, derivative, gradient, Jacobi matrix. Double and triple integral. Path and surface integral. Gauss, Green and Stokes theorem. (A2B01MA3)
4. Functions of complex variables. Cauchy-Riemann equations. Holomorphic functions. Path integral. Cauchy integral theorem. Series of functions, power series. Laurant and Fourier series. Residue theorem. (A2B99MAA)
5. Kinematics, Newton's laws, work, power and energy. Mechanical oscillating systems, resonance. Conservation of linear momentum and conservation of energy laws. Quantum mechanics. Special theory of relativity (A2B02FY1).
6. Kinetic theory of gases, mechanics of fluids. Thermodynamics. Huygen's principle. Doppler's effect, wave equation. Optics (geometrical and wave). Photometry. Polarization, dispersion. Nuclear physics. (A2B02FY2)
7. Electrostatic and stationary field, potential, voltage, energy and forces, superposition. Capacitance, inductance, boundary between materials, work, energy and forces in electromagnetic field, (A2B17EPV)
8. Harmonic electromagnetic wave, wave equation, wave on boundary between materials, Pointing's theorem. Parameters of a transmission line, transmission, reflection, impedance, Smith chart (A2B17EPV)
9. Properties of semiconductors and semiconductor structures (P-N junction, Metal Semiconductor junction, heterojunctions, Metal Insulator Semiconductor structure), passive electronic devices (structures, properties, models and applications). (AE2B34ELP)
10. Active electronic devices (transistors MOSFET, BJT, JFET), power semiconductor devices, optoelectronic devices, logical gates and memories - principles, structures, characteristics, models and applications. (AE2B34ELP)
11. Time and frequency representation of signals, classification of signals and systems, basic theorems, correlation, second order statistics. (AE2B99SAS)
12. Pass-band signals, complex envelope, discrete Hilbert transform, sampling and interpolation, types of analogue and digital modulations, intermodulation. (AE2B99SAS)
13. Basic laws and theorems. Kirchhoff's circuit laws. Elementary and general methods of electrical circuit analysis - nodal-voltage analysis, mesh (loop) analysis. Thévenin's and Norton's theorem. (AE2B31ZEO)
14. Sinusoidal steady state analysis. Phasors. Resonant circuits. Transient analysis. Frequency response of elementary circuits, asymptotic approximation. (AE2B31ZEO)
15. Devices measuring electric current, voltage and power, frequency and phase difference and basic parameters of passive elements (resistance, inductivity, capacity). Device errors and measurement uncertainty. AD and DA convertors. Multimeters, oscilloscopes. (A2B38EMB)
16. Combinational circuits, sequential circuits, functions, description, examples of realization, design methodology. Programmable logic circuits, gate arrays, VHDL, application of microprogrammable machine and microprocessor system in logic functions. (A2B99DIT)
17. Amplifiers with transistors and operational amplifiers (linear, nonlinear, selective), using and properties of feedback. Circuits for signal generation - monostable trigger circuits and multivibrator, oscillators, operating principle of phase locked loop. (AE2B31ANO)
18. Properties of materials for electrical engineering, nanotechnology, transformers, rectifiers, generators, electric engines, Power engineering. Transmission and distribution of electric energy. Power plants. (A2B13PEL)

## Common Professional Part

1. Layered models of data communication, various network topologies, LAN networks, various protocol examples in TCP/IP architecture. (A2B32DAT)
2. WAN networks, Internet architecture, IPv4 addressing, routing protocols, IP multicasting. (A2B32DAT)
3. Radiocommunication link, parameters of antennas and transmission, spherical wave, Friis formula, geometric optics, Huygens principle, Fresnel zones, reflection, scattering, refraction, diffraction (A2B17PMS)
4. Propagation of wave in atmosphere, empiric and deterministic models. Directional and satellite links, mobile links, propagation in urban area and inside buildings, planning of cell nets. (A2B17PMS)
5. Phenomenon as well as principles (physical, electronic and optoelectronic ) using in sensors, MEMS and microactuators, parameters, sensor data processing, smart sensors (AE2B34SEI)
6. Sensors and actuators for quantities (mechanical, optical, thermal, magnetic, chemical). Working principles, structures, electronic circuits, properties. (AE2B34SEI)
7. Shannon communication chain, Information capacity of channel, Channel coding, Digital modulation, Multiplexing, Access methods, Radio communication chain blocks. (A2B99KOS)
8. Telecommunication line modelling, Chanel with noise and crosstalk, Functional blocs of modems, Digital interface parameters, Jitter and wander. (A2B99KOS)
9. Physiology and anatomy of vision. Image sensing and reproduction. Source coding of image information and video transmission systems. Digital photography, pre-processing methods. (A2B37MMT)
10. Physiology and anatomy of hearing. Electroacoustic transducers. Signal processing, recording and source coding of sound. Measuring methods in acoustics. (A2B37MMT)
11. Algorithm, programs and languages, Syntax, Basics of program language C++. (A2B77PR1)
12. Running program control, Program branching, Cycles, Procedures a functions, Structure of program, Principles of modular and object programming. (A2B77PR1)

## Branch Thematic Topics

### Branch Communication and Electronics

1. Parameters of RF circuits in frequency and time-domain, components of RF measurement setups, generators and signal-analyzers, power-measurement devices, RF and microwave oscilloscopes (AE2B17VFM)
2. Spectrum analyzers, spectrum measurements, scalar and vector network analyzers, transmission-media measurements, measurement of linear and non-linear parameters of RF circuits (AE2B17VFM)
3. Radio interface of communication systems. Transmitters, receivers, their components. Systems for radio, television and data transmission. (AE2B37KMM)
4. Measurement in time, spectral and modulation domains in communication systems. Measuring devices. Measurement of transmitters, receivers, component parts of communication systems. (AE2B37KMM)
5. Codecs, antialiasing and interpolation filters, differential analog signals interconnections, analog inputs and outputs qualities, SPDIF, AES-EBU, FireWire and Bluetooth interconnection (AE2B31HPM)
6. Multimedia instruction on PC-compatible processors (MMX, SSE, AltiVec). Multiply-Add unit in DSP. Comparison of FPGA and signal processor capabilities. Audioprocessors, graphic accelerators. (AE2B31HPM)
7. Amplifiers, signal generators, power supplies and charging of accumulators, industrial buses - applications in multimedia, security, automotive technology. (AE2B34IAE)
8. Design rules for electronic systems, project flow, technical and manufacturing documentation, component base, certification rules, design tools and support software. (AE2B34IAE)
9. Digital telephone transmission, connection systems, signaling, ISDN networks, NGN, ATM technology, VoIP. (AE2B32TSI)
10. PDH, SDH, OTH, principles of mobile communication, access networks, xDSL connections, wireless access networks. (AE2B32TSI)