ENDUROSAT

Master of Science “Space Engineering and Technology” exam curriculum

The entrance exam for the MSc program “Space Engineering and Technology” will be based on problems from the following topics in Engineering, Physics and Mathematics.

1. **Single-variable and multi-variable calculus:** Derivative and integration of single and multi-variable functions. Finding extrema of single and multi-variable functions. Line, surface and volume integration.
2. **Linear Algebra and Analytical Geometry:** Vector manipulation in arbitrary dimensions, matrix properties, multiplication and their use for coordinate transformations. Eigenvectors and eigenvalues decomposition.
3. **Vector analysis:** Differential operators: gradient, curl and divergence, interpretation and use. Integration of vector fields and use of Gauss’ and Stokes’ theorems.
4. **Complex numbers:** Algebraic operations (addition, multiplication, division), polar representation and interpretation, integration in the complex plane.
5. **Fourier Analysis:** Fourier series (with real or complex representation). Interpretation and application of the spectrum representation. Fourier transformation and convolution.
6. **Statistics and probability:** Probability density function (PDF), mean, variance, standard deviation and how those are computed for a given PDF. Basic combinatorics and well-known distributions such as Binomial, Poisson, Gaussian.
7. **Introductory Ordinary Differential Equations (ODEs):** Degrees of freedom, order and degree of equations and systems of equations. First and second order linear ODEs initial value problems, forced Harmonic oscillator.
8. **Classical Mechanics:** Principles of classical mechanics, kinetic and potential energy formulation, momentum, angular momentum, conservation laws and forces.
9. **Introductory Thermodynamics:** Ideal gas law, concept of thermodynamic equilibrium, thermodynamics laws, temperature and entropy. Conduction and radiative emission elementary description.
10. **Electrostatics:** Coloumb’s law, force and potential of electric fields, energy stored in electrostatic configurations, capacitance and RC circuits.
11. **Magnetostatics:** Faraday’s law, energy stored in constant magnetic field configurations, inductance and RL circuits.
12. **Electrodynamics:** Lorenz force and particle motion in electromagnetic fields. Electromagnetic waves in isotropic media, plane wave description and characteristics.
13. **Electric Circuits:** Kirchoff’s law, RCL circuits analysis and characteristic quantities. Application to basic passive circuits such as voltage dividers and passive filters.
14. **Semiconductors:** Diodes types, usage and characteristics. Bipolar transistors operational principles and characteristics. FET transistors types, parameters and characteristics. Integrated Circuit (IC) basic understanding.
15. **Operational amplifiers:** Usage, symbols and nodes. Positive and negative feedback OpAmp circuit diagrams. Key parameters and typical characteristics. Inverting and non-inverting amplifier schematics and operation.