SOFIA UNIVERSITY ST. KLIMENY OHRIDSKI

FACULTY: Physics

C U R R I C U L U M

Approved by:	Approved by the Academic Council with Record of Proceedings № ..... / .....

Professional Field: **5.3 "Communication and Computer Technique"**

Educational and Qualification Degree: **„Master"**

P	H	K	0	1	2	1	2	4

Master's Degree Program: **Aerospace Engineering and Communications (in English)**

Form of Study: **Full-time**
Length of Study (number of weeks*/-): **45 weeks**

Professional Qualification: **Master of Science in "Aerospace Engineering and Communications"**

Qualification Description

Master's Degree Program: Aerospace Engineering and Communications

1. Aims and Educational Objectives

Over the past few years, we have witnessed the rapid development of the space industry, generated mainly by many private companies and increased competition. This led to the availability of new possibilities for accessing and using outer space, which also supported the development of the aerospace sector in Bulgaria. The latter is also partly a result of Bulgaria joining the European Space Agency (ESA) as a Cooperating state. Due to the growth of the aerospace sector, many companies and government institutions are interested in it and are already looking to hire personnel trained in the field of aerospace engineering and communications. Still, the number of such young specialists is small and not sufficient for the development of companies in this field and for the emergence of new businesses. This is one of the main reasons for the creation in 2012 of the master's program "Aerospace Engineering and Communications" (ASEC) at the Faculty of Physics of Sofia University "St. Kliment Ohridski" - to prepare such specialists in the aerospace field with master's education who previously had bachelor's training in other fields. The master's education allows this to happen relatively fast (up to 1.5 years) compared to 4-year bachelor's studies. Therefore, the program is designed with a broad enough profile that includes a unique combination of aerospace engineering and satellite communications to attract suitably educated undergraduates to enter this promising field.

2. Terms of acceptance

The program is open to Bulgarian/EU citizens as well as to citizens of countries outside the EU. The working language during the studies is English and English language Level B2 is required. The program accepts applications from students with a bachelor's degree in physics, mathematics, engineering, and other technical and natural sciences bachelor studies close to the program's subject like electrical engineering, computer sciences, communication and information technologies, space engineering, space science, aviation technology, etc. The minimum undergraduate coursework must include at least 180 hours in basic undergraduate mathematics courses and at least 200 hours in basic undergraduate physics and electrical engineering courses. Moreover, there will be an interview with all applicants.

Applicants with deficiencies in their undergraduate curriculum may be accepted or conditionally accepted into the program at the discretion of the Head of the Program. Students accepted on a conditional basis may be required to take additional classes to address coursework deficiencies.

3. Description of the educational content (knowledge and skills required for a successful professional realization; general and theoretical background, specific areas of study, etc.)

The master's program "Aerospace Engineering and Communications" (ASEC) was launched in the academic year 2012/13 and has already accumulated considerable experience in training in the field. In 2021 the program went through a major update following the successful completion of the educational project "SpaceEdu4BG" which was supported and peer-reviewed by the European Space Agency through the PECS program. ASEC takes place in the Faculty of Physics, Sofia University, which is the faculty with the highest rank in the international university rankings, among all higher education institutions in Bulgaria. The research activity in the faculty is at a high level and represents a solid basis for training and development in space technologies. Over the years, many motivated and capable students have been trained, some of whom have already achieved successful career in the space field.

As part of their studies, graduates of ASEC acquire knowledge in the fields of aerospace engineering and wireless and satellite communications, covering the main activities of the modern space industry. In aerospace engineering, knowledge is acquired in the field of space physics, space weather

and its influence on space and ground infrastructure, space methods of research and analysis, materials with aerospace applications, aerodynamics, orbital dynamics, space mission design and analysis, small spacecraft design and manufacture, spacecraft thrusters, navigation, telemetry, satellite power systems, etc.

The curriculum of the Aerospace Engineering and Communications program contains a wide variety of student learning opportunities with emphasis on practices. The structure of the program includes 9 compulsory disciplines, covering the basic knowledge in the field, as well as numerous elective disciplines, course projects, practices and internships. In the first semester, only compulsory courses are studied together with the implementation of a course project. In the second semester, 3 compulsory and at least 2 elective subjects are studied, again with a course project. In the third semester there is 1 compulsory course, and all others are elective, which allows the students to choose the disciplines that fit their informed interest the best. The master thesis is prepared also in the third semester. An important part of the training is the course projects in the first two semesters, building solid practical skills for independent work and designing satellite mission segments and subsystems. In the last third semester, practice in aerospace engineering and communications is planned, including internships in companies or practice in research and development laboratories. The number of specialized elective courses is 18 in total, but students have the opportunity to also choose a course from the wide variety of courses of other master's programs in the Faculty of Physics.

The program is full-time study in the ASEC program period is 1.5 years or 3 semesters including 780 teaching hours with total of 65 ECTS credits. The training includes practical training or internship and course projects (10 ECTS credits) and thesis defense (15 ECTS credits). The well-chosen teaching team with extensive experience in the field successfully presents the modern trends and technologies of the studied problems.

4. Professional and general competences, specific competences

Graduates of the "Aerospace Engineering and Communications" program are prepared for practical work in the design, integration, assembly and maintenance of small aerospace devices and their communication equipment. In addition, they have both a general and a specific knowledge of the main applications of these devices, as well as the ability to propose and develop new applications.

Graduates of the master's program receive solid knowledge and can work in companies and institutions in field related to the integration and maintenance of small satellites and unmanned aerial systems, design and production of parts and subsystems for satellites, processing of satellite data and images, satellite navigation and telemetry (GPS systems), satellite communications, wireless and wired networks, electronics and information technology. They can continue their education as PhD students and apply for teaching positions.

5. Professional realization (according to the National Classification of Occupations in the Republic of Bulgaria /based on the International Standard Classification of Occupations (ISCO)/ and in reference to the place of the future specialists in the National Qualifications Framework for higher education and the European Qualifications Framework for higher education)

The principles underlying the Master's program "Aerospace Engineering and Communications", namely: interdisciplinarity, practical-oriented training, training with the help of a mixed team of university professors and well-prepared business specialists, compliance with the specific requirements of the growing aerospace and communication sector at any moment, and the wide-profile admission, provide serious prospects for the realization of the graduates of the ASEC master's program in Bulgaria and abroad.

They can be employed as specialists in various companies, state enterprises, agencies, etc., in positions related to the design, creation, maintenance, operation and applications of systems, devices and standards in the field of aero and space engineering, wireless communications, communication networks, satellite communication systems, optical networks and systems, etc. They may work as communication network and data transmission specialists in telecommunications companies or other businesses. They can work as managers in various companies and state institutions related to aerospace, communication, and information technologies. They can work as researchers or teachers in scientific institutes and universities.

According to the National Classification of Professions and Positions in the Republic of Bulgaria, graduates can work as: engineer in space technology and equipment; engineer in telecommunications (space); expert in aeronautical information service; expert in communications; specialist in application programming; technician in electrotechnical products; technician in microprocessor engineering.

PHK	0	1	2	1

Program code

Master's Degree Programme "Aerospace Engineering and Communications"

admission winter semester of 2024/2025 academic year

№	Course Code				Course Title	Type** - C, E, O	Semester	ECTS credits	Classes - total number					Classes per week	Assessment* - e, ca, ce, cont.
									Total	Lectures	Seminars	Practical Classes/ Observation	Self study		
1	*2*				*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*
Core Subjects															
1	N	0	0	8	Introduction to Space and Space Environment	C	1	3,5	105	30	15	0	60	2 1 0	E
2	N	0	0	9	Orbital Dynamics and Orbital Design	C	1	6,5	195	30	0	45	120	2 0 3	CE
3	N	0	1	0	Modulations, Coding and Information in Digital Communications	C	1	6	180	45	15	15	105	3 1 1	CE
4	N	0	1	1	Design and Analysis of Satellite Missions	C	1	6	180	30	0	45	105	2 0 3	CE
5	N	0	1	2	Fixed and Mobile Satellite Communication Systems	C	1	5	150	30	15	15	90	2 1 1	E
6	N	0	1	3	Satellite Integration and Qualification	C	2	4,5	135	15	0	30	90	1 0 2	CE
7	N	0	1	4	Integration and Programming of Nanosatellites	C	2	5,5	165	15	0	45	105	1 0 3	CE
8	N	0	1	5	Numerical Simulations for Space Applications	C	2	6	180	30	15	30	105	2 1 2	CA
9	M	2	6	7	Navigation and Telemetry of Small Aerospace Vehicles	C	3	4	120	30	15	15	60	2 1 1	E

Elective Courses – the chosen electives have to contribute to minimum 16 Credits

1	N	0	1	6	Introduction and Modern Concepts in the Space Weather Research	E	2	3,5	105	30	15	0	60	2 1 0	CE
2	N	0	1	7	Global Navigation Satellite Systems Basics and Applications	E	2	3,5	105	30	15	0	60	2 1 0	CE
3	N	0	1	8	Microwave Communication Devices and Systems	E	2	6	180	45	15	15	105	3 1 1	CE
4	N	0	1	9	Design of Satellite Structures and Mechanisms	E	2	5	150	15	0	45	90	1 0 3	CE
5	N	0	2	0	Antennas for Wireless Communication Systems	E	2	5	150	30	15	15	90	2 1 1	CE
6	N	0	2	1	Microcontrollers with Aerospace Application	E	2	4	120	30	0	30	60	2 0 2	CA
7	N	0	2	2	Vacuum Equipment and Technologies	E	2	6	180	45	0	30	105	3 0 2	E
8	N	0	2	3	Mathematical Modeling with Matlab	E	2	4	120	15	0	30	75	1 0 2	CA
9	N	0	2	4	Introduction to Data Analysis	E	2	4	120	15	0	30	75	1 0 2	CE
10	N	0	2	5	Plasma and Plasma Thrusters for Satellites	E	3	5	150	30	15	15	90	2 1 1	E
11	N	0	2	6	Project Management and Risk Assesment in Space Technologies	E	3	3,5	105	30	15	0			
12	N	0	2	7	Earth Observations	E	3	3,5	105	30	15	0	60	2 1 0	CE
13	N	0	2	8	Applied Electrodynamics	E	3	5	150	30	30	0	90	2 2 0	CE
14	N	0	2	9	Computer Design of Electronic Circuits	E	3	6	180	30	0	45	105	2 0 3	CE
15	N	0	3	0	Software Development Workflow	E	3	3,5	105	15	0	15	75	1 0 1	CE
16	N	0	3	1	Space 4.0	E	3	1,5	45	15	0	0	30	1 0 1	CA
17	N	0	3	2	Single-Time Course in Advanced Topics of Aerospace Engineering and Communications	E	2 or 3	4	120	30	15	0	75	2 1 0	CE
18					Elective Course from Another MA Program	E	2 or 3								

Internships

№	code				Internship	Type- C, E, O	Semester	ECTS credits	weeks	hours	Assessment* - e, ca, ce, cont.
2	M	8	9	7	Course Project on Design of Satellite Mission Segment	C	1	3	15	90	CA
3	M	8	9	8	Course Project on Design of Satellite Subsystems	C	2	3	15	90	CA
1	M	8	9	9	Educational Practice in Aerospace Engineering and Comunications	C	3	6	7	180	CA

* Type of exam: Exam (E), Continuous assessment (CA), Combined exam (CE)
** Type of course: Compulsory (C), Elective (E), Optional (O)

Degree Completion

Form of degree completion	ECTS credits	First State Exam Session	Second State Exam Session
Defence of an Master's thesis	15	February	July

The curriculum has been approved by the Faculty Council, Record of Proceedings № 1 from 16.01.2024

DEAN:.....
/Prof. DSc. G. Raynovski/

Georgi Rainovski
2024.01.18 18:47:38 +02'00'

Sofia University "St. Kliment Ohridski"

Curriculum Reference Statement

Area of Study "Communication and Computer Technique" / Master's Degree Programme "Aerospace Engineering and Communications"
form of study Full-time, length of study 3 Semesters

Course hours, ECTS credits and number of grades per semester

Type of courses	I semester			II semester			III semester			IV semester			V			VI			VII			VIII			Total		
	course hours	ECTS credits	number of grades	course hours	ECTS credits	number of grades	course hours	ECTS credits	number of grades	course hours	ECTS credits	number of grades	course hours	ECTS credits	number of grades	course hours	ECTS credits	number of grades	course hours	ECTS credits	number of grades	course hours	ECTS credits	number of grades	course hours	ECTS credits	number of grades
compulsory courses	**330**	**27**	**5**	**180**	**16**	**3**	**60**	**4**	**1**																**570**	**47**	**9**
min. elective courses	**0**	**0**	**0**	**165**	**11**	**3**	**75**	**5**	**2**																**240**	**16**	**5**
optional courses	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**																**0**	**0**	**0**
internships	**90**	**3**	**1**	**90**	**3**	**1**	**180**	**6**	**1**																**360**	**12**	**3**
Total:	**420**	**30**	**6**	**435**	**30**	**7**	**315**	**15**	**4**																**1170**	**75**	**17**

Form of degree completion	ECTS credits	Study Hours	First State Exam session	Second State Exam Session
Defence of a Master's thesis	15	450	February	July

Acquired Professional Qualification

Master of Science in "Aerospace Engineering and Communications"

Record of Proceedings of the Faculty Council № 1 from 16.01.2024

Dean:

Georgi Rainovski
2024.01.18 18:47:51
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Prof. DSc. G. Raynovski