



SOFIA UNIVERSITY "ST. KLIMENT OHRIDSKI"

FACULTY: Physics

CURRICULUM

Signed by: .....

Approved by the Academic Council,  
Record of Proceedings № ..... / .....

Professional Field: 5.3 "Communication and Computer Technique"

Educational and Qualification Degree: „Master of Science”

Subject Area:

P	H	P	3	4	2	4	2	3
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Aerospace Engineering and Communications

**Form of Study: Full-time**

**Length of Study: 3 semesters**

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

## **Qualification Description**

***Subject Area: Aerospace Engineering and Communications***

***MA Program: Aerospace Engineering and Communications***

### **1. 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 the process of Bulgaria joining the European Space Agency (ESA). 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 precisely 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. Description**

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. It 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. Research activity in the faculty is at an extremely 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 success in the 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 engines, navigation, telemetry, satellite power systems. Satellite systems are unthinkable without appropriate communication systems and therefore the other essential part of the program involves the knowledge in the field of wireless communications with these devices, of the signals, channels, networks, and equipment of wireless and satellite communication systems. The topics covered include microwave communication devices and systems, microwave measurements, wireless networks and protocols, antennas and antenna arrays, and others.

The curriculum of the Aerospace Engineering and Communications program contains a wide variety of student learning opportunities. The structure of the program includes 8 compulsory disciplines, covering the basic necessary general 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 3 elective subjects are studied, again with a course project. In the third semester, elective courses are studied, and a thesis is prepared. An important part of the training are the course projects in the first two semesters, building solid practical skills for independent work and designing satellite missions and systems. In the last third semester, practice in aerospace engineering and communications is planned, including internships in companies or practice in research and development laboratories. Thanks to the possibility of choosing many of the courses, students can set a narrow direction of their development and interests. The number of specialized elective courses is 15 in total, but students have the opportunity to 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 (10.5 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.

### **3. Professional Qualifications**

Graduates of the "Aerospace Engineering and Communications" program are prepared for practical work in the design, creation, 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 building and maintenance of small satellites and unmanned aerial systems, design and production of parts and systems 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.

### **4. Professional Realization**

The solid interdisciplinary curriculum of the MSc program "Aerospace Engineering and Communications" combined with practical-oriented training and the excellent team of university professors provide serious prospects for the professional realization of graduates of the master's program ASEC. 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.

### **5. 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, 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 240 hours in basic undergraduate physics and electrical engineering courses. 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.

PHP	3	4	2	4
Program code				

## Master of science program "Aerospace Engineering and Communications"

Duration: 3 semesters; full-time

Professional Field: 5.3. COMMUNICATION AND COMPUTER TECHNIQUE

academic year beginning from 2023/ 2024

№	Course code	Course Title	Type* – C, E, O	Term	ECT S credits	Number of classes- total				Number of classes per week	Type of Grading** - E, CA, CE
						Total	Lectures	Seminars	Practical classes / practice		
1	2	3	4	5	6	7	8	9	10	11	12

### Compulsory courses I semester

1	E 8 6 5	Introduction to Space and Space Environment	C	1	3.5	105	30	15	0	2 1 0	E
2	M 8 8 2	Design and Analysis of Satellite Missions	C	1	6	165	30	0	45	2 0 3	CE
3	M 0 3 1	Fixed and Mobile Satellite Communication Systems	C	1	5	150	30	15	15	2 1 1	E
4	M 8 8 3	Orbital Dynamics and Orbital Design	C	1	6.5	180	30	0	45	2 0 3	CE
5	M 1 9 2	Microcontrollers with Aerospace Application	C	1	6	150	30	0	30	2 0 2	CA

### Compulsory courses II semester

6	M 1 9 5	Navigation and Telemetry of Small Aerospace Vehicles	C	2	5	150	30	15	15	2 1 1	E
7	M 8 8 4	Aerodynamics and Fluid Modelling	C	2	6	180	30	30	15	2 2 1	CE
8	M 8 8 5	Integration and Programming of Nanosatellites	C	2	5.5	150	15	0	45	1 0 3	CE

### Elective Courses II semester \*\*\*

9	M 8 7 1	Space and Technology Entrepreneurship	E	2	3.5	105	30	15	0	2 1 0	CE
10	M 8 8 7	Management of Innovations	E	2	5	150	30	30	0	2 2 0	CE
11	M 8 7 5	Introduction and Modern Concepts in the Space Weather Research	E	2	3.5	105	30	15	0	2 1 0	CE
12	M 8 7 3	Global Navigation Satellite Systems Basics and Applications	E	2	3.5	105	30	15	0	2 1 0	CE
13	M 8 8 8	Microwave Communication Devices and Systems	E	2	6	150	45	15	15	3 1 1	CE
14	M 8 9 2	Design of Satellite Constructions and Mechanisms	E	2	5	150	15	0	45	1 0 3	CE
15	M 8 9 4	Antennas for Wireless Communication Systems	E	2	5	150	30	15	15	2 1 1	CE
16	M 8 9 5	Single-Time Course in Advanced Topics of Aerospace Engineering and Communications	E	2 or 3	5	105	30	15	0	2 1 0	CE
17	M 8 9 6	Elective Course from Another MA Program	E	2 or 3							

1	2	3			4	5	6	7	8	9	10	11	12
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### Elective Courses III semester \*\*\*

18	M	8	8	6	Plasma and Plasma Propulsion Engines for Satellites	E	3	5	150	30	15	15	2 1 1	E
19	E	8	6	3	Project Management and Risk Assessment in Space Technologies	E	3	3.5	105	30	15	0	2 1 0	CE
20	M	8	7	2	Earth Observations	E	3	3.5	105	30	15	0	2 1 0	CE
21	M	0	1	8	Modulations, Coding and Information in Digital Communications	E	3	6	180	45	15	15	3 1 1	CE
22	M	8	8	9	Modern Electromagnetic Materials and Electronic Devices	E	3	5	105	30	15	0	2 1 0	E
23	M	8	9	0	Vacuum Technique	E	3	3	105	30	15	0	2 1 0	E
24	M	8	9	1	Vacuum Technique - Laboratory Practice	E	3	3	90	0	0	30	0 0 2	E
25	M	8	9	3	Applied Electrodynamics	E	3	5	150	30	30	0	2 2 0	CE
26	M	8	9	5	Single-Time Course in Advanced Topics of Aerospace Engineering and Communications	E	2 or 3	5	105	30	15	0	2 1 0	CE
27	M	8	9	6	Elective Course from Another MA Program	E	2 or 3							

\* Type of course: Compulsory (C), Elective (E), Optional (O).

\*\* Type of exam: Exam (E), Continuous assessment (CA), Combined exam (CE)

\*\*\* The elective courses in semester II must provide at least 10.5 ECTS credits, while in semester III at least 10 ECTS credits. All elective courses must provide at least 21 ECTS credits. The elective course from another MA program can be elected only once.

### Study Internships

No	code				Internship	Type - C, E, O	Semester	ECTS - credits	Weeks	Number classes	Type of course completion - E, CA, CE
1	M	8	9	9	Educational Practice in Aerospace Engineering and Communications	C	3	4.5	7	90	CA

1	2	3	4	5	6	7	8	9	10	11	12
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**Teaching practice**

№	code			Title	Type - C, E, O	Semester	ECTS - credits	Weeks	Number classes	Type of course completion - E, CA, CE
	M	8	9							
2	M	8	9	7	C	1	3	15	60	CA
3	M	8	9	8	C	2	3	15	60	CA

**Degree completion**

Form of degree completion	ECTS credits	First state exam/ thesis defence session	Second state exam/thesis defence session
MSc. Thesis defence	15	February	July

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

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

Sofia University "St. Kliment Ohridski"

**Curriculum Reference Statement**

Professional Field: 5.3. COMMUNICATION AND COMPUTER TECHNIQUE  
 Master of science program "Aerospace Engineering and Communications"

Form of study: FULL TIME, length of study: 3 semesters

Course Load, ECTS -credits and course completion per semester												
Type of courses	I semester			II semester			III semester			Total		
	Course Load - number of classes	ECTS – credits	number of grades	Course Load - number of classes	ECTS – credits	number of grades	Course Load - number of classes	ECTS – credits	number of grades	Course Load - number of classes	ECTS – credits	number of grades
Compulsory courses	750 (315)	27	5	480 (195)	16.5	3	0	0	0	1230 (510)	43.5	8
Min. of elective courses	0	0	0	270 (135)	10.5	3	270 (135)	10.5	3	540 (270)	21	6
Study internships	60	3	1	60	3	1	90	4.5	1	210	10.5	3
<b>Total:</b>	<b>810 (375)</b>	<b>30</b>	<b>6</b>	<b>810 (390)</b>	<b>30</b>	<b>7</b>	<b>360 (225)</b>	<b>15</b>	<b>4</b>	<b>1980 (990)</b>	<b>75</b>	<b>17</b>

Degree completion						ECTS - credits	number of hours for preparation	First state exam/ thesis defence session	Second state exam/ thesis defence session
MSc. thesis defence						15	450	February	July

**Professional Qualification:**

Master of Science in Aerospace engineering and communications

**Record of Proceedings of the Faculty Council N° ..... from.....**

**Dean:**

Prof. DSc. G. Raynovski