SAMARA STATE AEROSPACE UNIVERSITY

Biomedical engineering

Educational program

01.01.2014

Biomedical systems and biotechnology
(Biomedical engineering)

Undergraduate
(Bachelor program)

Undergraduate 4 years course of study – 240 ECTS credit hours, 60 ECTS credit hours per year, 30 ECTS credit hours per semester, 1.5 ECTS credit hours per week.
Note: All courses are calculated in ECTS (European Credit Transfer and Accumulation System) credit hours. 1 ECTS credit hour approximately equal to 0.6 US credit hour.

Undergraduate Course Blocks:

- Humanitarian, social and economics – 34 ECTS credit hours;
- Mathematics, Physics and Chemistry – 68 ECTS credit hours;
- Professional courses – 112 ECTS credit hours;
- Elective courses and Bachelor thesis - 16 ECTS credit hours;
- Physical culture – 10 ECTS credit hours.

Undergraduate Curriculum Course Description

1 Year		**60 ECTS**	
1.1	History	3.0 ECTS	Required
1.2	Foreign language I	4.0 ECTS	Required
1.3	History of science & engineering	2.0 ECTS	Required
1.4	Mathematics I	11.0 ECTS	Required
1.5	Physics I	11.0 ECTS	Required
1.6	Chemistry I	4.0 ECTS	Required
1.7	Linear algebra	6.0 ECTS	Required
1.8	Information Technologies	3.0 ECTS	Required
1.9	Engineering Graphics and Design	5.0 ECTS	Required
1.10	Biomaterials	4.0 ECTS	Required
1.11	Electrical engineering I	4.0 ECTS	Required
1.12	Physical culture I	3.0 ECTS	Required
2 Year		**60 ECTS**	
2.1	Philosophy	5.0 ECTS	Required
2.2	Foreign language II	4.0 ECTS	Required
2.3	Mathematics II	11.0 ECTS	Required
2.4	Physics II	5.0 ECTS	Required
2.5	Biochemistry	3.0 ECTS	Required
2.6	Fundamentals of biology and genetics	4.0 ECTS	Required
2.7	Electrical engineering II	4.0 ECTS	Required
2.8	Electronic components	5.0 ECTS	Required
2.9	Computer design of electronic medical devices	3.0 ECTS	Required
2.10	Signal and system analysis I	3.0 ECTS	Required
2.11	Analog electronics I	3.0 ECTS	Required
2.12	CAD systems for medical devices	5.0 ECTS	Required

2.13	Elective course I	2.0 ECTS	Required
2.14	Physical culture II	3.0 ECTS	Required
3 Year		**60 ECTS**	
3.1	Economics	4.0 ECTS	Required
3.2	Political science	2.0 ECTS	Required
3.3.1	Russian language	3.0 ECTS	Selectable
3.3.2	Culturology	3.0 ECTS	Selectable
3.4.1	Sociology	3.0 ECTS	Selectable
3.4.2	Psychology	3.0 ECTS	Selectable
3.5	Ecology	2.0 ECTS	Required
3.6	Fundamentals of vibrations	4.0 ECTS	Required
3.7	Fundamentals of biological systems	4.0 ECTS	Required
3.8	Metrology and standardization	4.0 ECTS	Required
3.9	Biotechnical systems components	5.0 ECTS	Required
3.10	Applied mechanics	4.0 ECTS	Required
3.11	Signal and system analysis II	4.0 ECTS	Required
3.12	Analog electronics II	4.0 ECTS	Required
3.13	Digital electronics	2.0 ECTS	Required
3.14	Microprocessor devices I	3.0 ECTS	Required
3.15	BioSensors	3.0 ECTS	Required
3.16	Design principles of medical equipment	4.0 ECTS	Required
3.17	Elective course II	4.0 ECTS	Required
3.18	Physical culture III	1.0 ECTS	Required
4 Year		**60 ECTS**	
4.1	Jurisprudence	2.0 ECTS	Required
4.2.1	Fundamentals of Management	2.0 ECTS	Selectable
4.2.2	Fundamentals of Marketing	2.0 ECTS	Selectable
4.3.1	Modeling of biological processes	4.0 ECTS	Selectable
4.3.2	Fundamentals of discrete mathematics	4.0 ECTS	Selectable
4.4.1	Electromagnetic fields	3.0 ECTS	Selectable
4.4.2	Experimental fundamentals in biology and medicine	3.0 ECTS	Selectable
4.5	System analysis	2.0 ECTS	Required
4.6	Control in engineering systems	3.0 ECTS	Required
4.7	Technical methods of diagnosis and treatment modalities	3.0 ECTS	Required
4.8	Automation processing of biomedical information	3.0 ECTS	Required
4.9	Bioengineering system	3.0 ECTS	Required
4.10	Life Safety	3.0 ECTS	Required
4.11	Microprocessor devices II	4.0 ECTS	Required
4.12	Digital signal processing	4.0 ECTS	Required
4.13	Certification of medical devices	3.0 ECTS	Required
4.14.1	Laser medical devices	2.0 ECTS	Selectable
4.14.2	Ultrasound methods and facilities	2.0 ECTS	Selectable
4.15.1	Reliability Methods in instrumentation	2.0 ECTS	Selectable
4.15.2	Medical image processing	2.0 ECTS	Selectable
4.16.1	Nanotechnology	3.0 ECTS	Selectable
4.16.2	Space medical equipment	3.0 ECTS	Selectable
4.17.1	Microwave medical equipment	2.0 ECTS	Selectable
4.17.2	Medical instruments and apparatus	2.0 ECTS	Selectable

4.18	Bachelor thesis	12.0 ECTS	Required

Graduate

SSAU offers graduate programs leading to the following degrees:

- Master of Science in Biomedical Engineering – 2 year program;
- Doctor of Philosophy in Optics (including Biomedical optics) – 4 year program;
- Doctor of Philosophy in Medical devices and systems – 4 year program;

Master program

The graduate program for master of science (master program) is open to all qualified individuals with a Bachelor of Science (B.S.) in Biomedical Engineering or Biotechnology.

Master program requires the completion of 120 ECTS credit hours of approved graduate work distributed as follows:

1	**Core Science courses**	**16.0 ECTS**	
1.1	Methodology of science and technology in biomedicine	2.0 ECTS	
1.2	Mathematical simulation of biological systems and processes	2.0 ECTS	
1.3	Metrological maintenance of medical equipment	3.0 ECTS	
1.4	Scientific research fundamentals	3.0 ECTS	
1.5.1	Computer technologies	2.5 ECTS	Selectable
1.5.2	Nanoengineering fundamentals	2.5 ECTS	Selectable
1.6.1	Ecological monitoring systems	3.5 ECTS	Selectable
1.6.2	Modern diagnostic and therapeutic systems in healthcare	3.5 ECTS	Selectable
2	**Professional courses**	**45.0 ECTS**	
2.1	Bioengineering systems and technologies	4.5 ECTS	
2.2	Modern problems of biomedical and environmental engineering	4.5 ECTS	
2.3	Mathematical methods in biomedical data processing	2.5 ECTS	
2.4	Fundamentals of marketing and management on medical market	1.5 ECTS	
2.5	Telemedicine systems	3.5 ECTS	
2.6	Cardiovascular diagnostics	3.0 ECTS	
2.7	The impact of space on biological objects (Space biology)	3.5 ECTS	
2.8	Computer tomography	3.0 ECTS	
2.9	Apparatus and methods of clinical monitoring	5.0 ECTS	
2.10	Ultrasound equipment	4.5 ECTS	
2.11.1	Laser diagnostic systems	2.0 ECTS	Selectable
2.11.2	Biomedical imaging	2.0 ECTS	Selectable
2.12.1	Optical Imaging	2.0 ECTS	Selectable
2.12.2	Image reconstruction	2.0 ECTS	Selectable
2.13.1	Diagnostic systems of human in space flight	2.0 ECTS	Selectable
2.13.2	Microwave effects	2.0 ECTS	Selectable
2.14.1	Bio-electro-stimulation	3.5 ECTS	Selectable
2.14.2	Laser monitoring systems	3.5 ECTS	Selectable
3	**Research & Master thesis**	**59.0 ECTS**	

Ph.D. Programs

PhD programs are open for all qualified individuals with Master's of Science (M.S.) in Physics, Optics and/or Engineering or related field.

Ph.D. program minimum duration is 3 years, maximum duration – 4 years.

Ph.D. program requires the completion of minimum 60 ECTS credit hours, success Ph.D. Examinations and Ph.D. Thesis:

1	**Core courses**	**4.0 ECTS**
1.1	Philosophy	2.0 ECTS
1.2	Foreign language	2.0 ECTS
2	**Special Courses**	**16.0 ECTS**
	Ph.D. in Medical devices and systems	
2.1	Advanced mathematical simulation of biological processes	4.0 ECTS
2.2	Advanced biomedical imaging	4.0 ECTS
2.3	Advanced telemedicine	4.0 ECTS
2.4	Advanced bioelectromagnetic systems	2.0 ECTS
2.5	Physiotherapy methods and equipment	2.0 ECTS
	Ph.D. in Optics	
2.1	Optical signal processing	4.0 ECTS
2.2	Fiber optics	4.0 ECTS
2.3	Biooptics	4.0 ECTS
2.4	Synthesis of optical system	2.0 ECTS
2.5	Optical systems layout optimization	2.0 ECTS
3	**Elective courses**	**20.0 ECTS**
4	**Ph.D. Examinations**	**3.0 ECTS**
4.1	Examination in Philosophy	1.0 ECTS
4.2	Examination in Foreign language	1.0 ECTS
4.3	Examination in selected specialization	1.0 ECTS
5	**Research & Ph.D.Thesis**	
	Minimum (3-year)	160.0 ECTS
	Maximum (4-year)	220.0 ECTS

Notes:
1) Elective courses should be chosen based on research interest and with the input of the research supervisor;
2) Ph.D. research assumed finished after completed of Ph.D. Thesis.

Contacts

Ph.D. Ilya A. Kudryavtsev
Dean of Radio Engineering Faculty,
Phone: +7-846-335-1855
E-mail: rtf@ssau.ru

Professor Valery P. Zakharov
Head of Optics and Biomedical Engineering Department,
Phone: +7-846-267-4550
E-mail: zakharov@ssau.ru

SSAU web site: http://www.ssau.ru/english/