

# Master of Science in Computer Science (MSCS)

## Degree Type

Master of Science

## **(Hybrid, a combination of Campus and Online Courses)**

## Program Overview

The Master of Science in Computer Science (MSCS) STEM Program with Work Integrated Learning (WIL) at Sofia University is a rigorous and comprehensive graduate program that provides a sound foundation in core computer science principles as well as in cutting edge computer science specializations. It provides thorough coverage of the theory of computer science while providing relevant, practical, and applicable knowledge in a broad range of applied and advanced topics that are enhanced by integrating theory and practice in an innovative STEM based WIL environment. The program focuses on innovative, transpersonal, and transformative learning in the classroom and at the workplace to ensure that students are well prepared for the technical and managerial challenges of the rapidly evolving computing, engineering, and scientific industries as well as the challenges of future academic and research-based endeavors.

The MSCS STEM program includes a science, technology, engineering, and management focus (STEM). This facilitates a well-rounded industry centric approach to computer science to ensure that students are prepared to face the global challenges of the current technological environment. The program integrates solid foundations in the managerial, engineering, and scientific aspects of computer science, such as software, systems, and computer engineering, risk and safety management, software product management, as well as the core scientific, technological, and mathematical aspects of computer science and its integration with business, scientific, and engineering information systems as well as science, engineering, and business analytics programs.

The MSCS STEM program has a pedagogically integrated Work Integrated Learning (WIL) component that allows all students to participate in a career-based work environment that directly maps to the MSCS curricula. The WIL program allows students to directly apply their learning in a highly technical environment while being mentored by an experienced faculty member. Within the WIL program, students will learn technology skills and apply them to their MSCS program while developing lessons learned documents, work application summaries, and technical products that reflect on their newly acquired workplace skills. Students will interact weekly with other STEM WIL students to share experiences and provide peer guidance and advice. The work supervisor at the workplace will also be involved in the student's learning process through comprehensive feedback to assist the student. This communication will be facilitated through the faculty mentor.

Overall, the Work Integrated Learning based MSCS STEM program will provide students with valuable real time practical and adaptable work experience that will assist them in learning core computer science topics and provide a platform to help them reflect on their experiences to promote competence development and shared experiences with complete support by MSCS faculty and student peers.

## Program Learning Outcomes

Upon successful completion of the Master of Science in Computer Science program, students will be able to:

- Integrate and apply to a workplace environment, sound computer science principles, logic, and mathematics in an innovative managerial manner in myriad science, technology, and engineering industries.
- Integrate computer science principles with sound research, writing, and analytic capabilities to foster professional managerial communications and knowledge expression in science, technology, and engineering (STEM) based industries.

- Succeed in a demanding technological workplace using both inventive and innovative computer science skills and capabilities to become transpersonal, transformative managers and leaders in the science, technology, and engineering (STEM) industries.
- Integrate sound managerial judgment with computer science skills in the workplace to provide legal and ethical solutions to science, technology, engineering, and math (STEM) problems with responsible, transpersonal, and transformative reflection on the social impacts of those solutions.

## Degree Requirements

To receive a Master of Science in Computer Science degree, students of the Master of Science in Computer Science STEM-based Work Integrated Learning (WIL) centric curriculum must successfully complete a minimum of 42 units. The following are specific degree requirements:

- **24 units in Mandatory Core Courses**
- **12 units in Concentration Courses**
- **3 units in Elective**
- **3 units in Capstone Course**
- **Work Integrated Learning Based Internship Program**

## Mandatory Core Courses (24 units)

There are 8 mandatory computer science foundational courses that must be completed. Each course is 3 units for a total of 24 mandatory core units.

Item #	Title	Credits
MSCS2103	Systems Programming	3.0
MSCS3801	Discrete Mathematics for Computer Science	3.0
MSCS3917	Automata and Algorithms	3.0
MSCS2401	Data Science	3.0
MSCS2202	Machine Learning	3.0
MSCS2101	Software Engineering	3.0
MSCS3804	Cyber Security and Information Assurance	3.0
MSCS3019	Data Visualization	3.0

## Concentration Courses (12 units)

A student is required to select one of four computer science concentrations and complete the 4 mandatory courses in that concentration. Each concentration course is 3 units for a total of 12 concentration course units.

### Artificial Intelligence and Machine Learning

Item #	Title	Credits
MSCS3805	Statistical Analysis for Computer Science	3.0
MSCS2201	Artificial Intelligence	3.0
MSCS3008	Introduction to Robotics	3.0
	MSCS3808 or MSCS3806	3

## Cyber Security and Information Assurance

Item #	Title	Credits
MSCS3920	Cyber Security: Defense	3.0
MSCS3921	Cyber Security: Forensics and Attack Analysis	3.0
MSCS2219	Advanced Threat Analysis	3.0
MSCS3922	Applied Cryptography	3.0

## Data Science

Item #	Title	Credits
MSCS3020	Mining Massive Data Sets	3.0
MSCS3805	Statistical Analysis for Computer Science	3.0
	MSCS3807 or MSCS3219	3
MSCS3809	Advanced Data Science	3.0

## Human Computer Interaction

Item #	Title	Credits
MSCS3219	Advanced Data Visualization	3.0
MSCS3204	Web Development	3.0
MSCS3206	Interaction Design for Software Products	3.0
MSCS3207	Ethnographic Research	3.0

# Work Integrated Learning Based Internship Program (0 Units)

Students pursuing the Computer Science Degree Program are required to pass Sofia University's 0-credit internship class, Work Integrated Learning (WIL). WIL is a graduation requirement and an integral part to a student's degree program. Additionally, after completion of the WIL internship class, students have the option to re-enroll in following terms, which will aid them on their continued internship journey while in the Computer Science program.

To qualify for the WIL course, the internship, employment, or volunteer experience must be related to the student's degree program. The course is 0-credits and does not count towards full-time enrollment requirement.

The requirements for students to pass WIL include:

- Complete experience hours designated by program chair by the end of the term
- Successful completion of course assignments
- Active engagement with faculty supervisor

\*International students will need CPT authorization to take this course and must communicate with the International Office ([DSO@sofia.edu](mailto:DSO@sofia.edu)) before engaging in any employment.

How to Apply for WIL

To apply, students must communicate with a Sofia University Faculty Advisor. The following forms are required:

- WIL Application Form
- An employment letter (including the correct start date, work location, job title/description, and hours)

\*F-1 international students must also receive approval from Sofia's International Office ([DSO@sofia.edu](mailto:DSO@sofia.edu)) and a CPT I-20 before engaging in any employment.

After approval, the student will be officially enrolled into the WIL course for the following term.

Item #	Title	Credits
WILC5000	Full-Time Internship in Computer Science	0.0

## Elective Courses (3 units)

A total of 3 units of electives in the computer science, psychology, or business programs must be completed.

# Capstone Course (3 Units)

A student must complete the capstone course in the last term of study. The capstone course is mandatory for all students and is 3 units.

Item #	Title	Credits
MSCS1022	Technical Writing and Analysis for Computer Scientists: Capstone	3.0

## Graduation Requirements

In order to graduate from Sofia University with the Master of Science in Computer Science, a student must:

1. Successfully complete all core, concentration, and WIL/elective requirements
2. Successfully Complete the Capstone Course
3. Successfully complete a minimum of 42 credits\*
4. Pay all tuition and fees

\*Total credits:

42 credits inclusive of one Concentration

51-54 credits if the student declares a second Concentration

Total Credits	42-54
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## Course Sequencing

## Optional Certificates

The graduate computer science certificate program prepares students for the challenges of computer science in a competitive global environment and gives them the career-based tools that they need to move humanity forward in a transformative, transpersonal manner with a solid foundation in STEM based computer science.

# Graduate Certificate in Artificial Intelligence and Machine Learning

The Graduate Certificate in Artificial Intelligence and Machine Learning is a cutting-edge, full-spectrum AI program that covers Artificial Intelligence from the hardware-intensive robotics side to the data/machine learning-centric software side in a highly integrated curriculum.

The robotics portion of the program covers both the hardware and electronics of robotics and software applications such as machine learning, natural language processing, and deep learning. Robotics labs are pervasive throughout the robotics courses and include continual hands-on robot building from basic electronics to fully software-integrated robotic systems.

The data science and machine learning portion of the program utilizes the latest software tools to analyze and develop comprehensive AI solutions on a wide variety of topics ranging from medicine and science to business and social media applications.

As a whole, the AI certificate prepares students to enter into the AI field in any scientific, business, or research-based domain with the skills necessary to become an AI expert in that field. All courses in the certificate program are reviewed on a quarterly basis to ensure that all material taught is current, relevant, and cutting-edge. All industry-relevant tools utilized in the program are also reviewed and updated regularly to ensure that students are job-ready when they complete the program.

## Plan of Study

The Graduate Certificate in Artificial Intelligence & Machine Learning is comprised of the following courses:

### Artificial Intelligence & Machine Learning Certificate Courses (18 Units):

Item #	Title	Credits
MSCS2401	Data Science	3.0
MSCS2202	Machine Learning	3.0
MSCS3808	Advanced Robotics Computing	3.0
MSCS2201	Artificial Intelligence	3.0
MSCS3008	Introduction to Robotics	3.0
MSCS3806	Advanced Topics in AI and Machine Learning	3.0

# Graduate Certificate in Cybersecurity and Information Assurance

The Graduate Certificate in Cybersecurity and Information Assurance is a comprehensive hands-on program that covers the field of cyber security from both an ethical offensive perspective to a defensive preventative perspective to ensure that students fully understand the entire realm of global cyber security and information assurance. The program focuses on all aspects of cyber security from physical security through advanced cryptologic security and utilizes current and relevant tools to ensure that students are well equipped as they enter the cyber security field.

The certificate program also focuses on the vital skills and tools of machine learning and data visualization, which are pervasive and highly desired in the cybersecurity domain. Students are taught data visualization and machine learning skills so that they can perform such tasks as advanced attack campaign and defense analysis, malware forensics/reverse engineering, and malware detection through deep learning and neural networks, which are skills that are in high demand in the cyber security domain.

The program also focuses on cryptography to ensure that students are well versed in encryption and encryption-based attack and defensive systems. Machine learning based hands-on applications are presented as major tools in the cryptologic domain to ensure that students are skilled in their programming and application.

All courses in the certificate program are reviewed on a quarterly basis to ensure that all material taught is current, relevant, and cutting-edge. All industry-relevant tools utilized in the program are also reviewed and updated regularly to ensure that students are job-ready when they complete the program.

## Plan of Study

The Graduate Certificate in Cyber Security is comprised of the following courses:

### Cyber Security Certificate Courses (18 Units)

Item #	Title	Credits
MSCS3920	Cyber Security: Defense	3.0
MSCS3921	Cyber Security: Forensics and Attack Analysis	3.0
MSCS2219	Advanced Threat Analysis	3.0
MSCS3922	Applied Cryptography	3.0
MSCS3804	Cyber Security and Information Assurance	3.0
MSCS2202	Machine Learning	3.0

### Notes