ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING, BACHELOR OF SCIENCE

STEM

Bachelor of Science: BS 9310
120 Credits
Program Contact
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Program Description

The Bachelor of Science (BS) in Artificial Intelligence and Machine Learning provides students with the skills needed for designing and developing machine learning models for predictive analysis, automated decision-making, and the augmentation of human capabilities. The program prepares students for careers as developers and engineers in various fields using artificial intelligence, including information technology, automotive, healthcare, aerospace, finance, industrial, semiconductor, and manufacturing industries. Program content includes in-depth coverage of artificial intelligence, statistical machine learning, deep learning, natural language processing, computer vision, hardware-based optimization, and industrial automation. The curriculum emphasizes computer science, mathematics, and engineering content.

Program Notes

Students must earn a grade of C or better in each course in the program.

Program Requirements

Program Prerequisites: None

Code	Title	Credits	Semester
Required Courses			
AIM100	Introduction to Artificial Intelligence	3	
AIM111	Introduction to Data Science	3	
AIM250	Machine Learning I	3	
BAM/MAT305	Mathematics for Machine Learning	3	
BAM310	Machine Learning II: Deep Learning	3	
BAM320	Computer Vision	3	
BAM330	Natural Language Processing for Machine Learning	3	
BAM440	Hardware Optimization for Machine Learning	3	
BAM450	Planning and Optimization for Automation	3	
BAM490	Artificial Intelligence Capstone I	3	
BAM499	Artificial Intelligence Capstone II	3	
CSC100	Introduction to Computer Science (C++)	3-4	
or CSC100AA	Introduction to Computer Science (C++)		
or CSC100AB	Introduction to Computer Science (C++)		
or CSC110	Introduction to Computer Science (Java)		
or CSC110AA	Introduction to Computer Science (Java)		
or CSC110AB	Introduction to Computer Science (Java)		
CSC101	Introduction to Computing with Python	3	
CSC/EEE120	Digital Design Fundamentals	4	
CSC205	Object Oriented Programming and Data Structures	3-4	
or CSC205AA	Object Oriented Programming and Data Structures		
or CSC205AB	Object Oriented Programming and Data Structures		
CSC/EEE230	Computer Organization and Assembly Language	4	
CSC240	Introduction to Different Programming Languages	3-4	
or CSC240AA	Introduction to Different Programming Languages		
CSC310	Data Structures and Algorithms	3	
CSC350	Logic Programming for Artificial Intelligence	3	

FYE101	Introduction to College, Career and Personal Success	1-3	_____
or FYE103	Exploration of College, Career and Personal Success		_____
MAT206	Elements of Statistics	3	_____
MAT220	Calculus with Analytic Geometry I	4-5	_____
or MAT221	Calculus with Analytic Geometry I		_____
MAT225	Elementary Linear Algebra	3	_____
MAT227	Discrete Mathematical Structures	3	_____
MAT230	Calculus with Analytic Geometry II	4-5	_____
or MAT231	Calculus with Analytic Geometry II		_____
Restricted Electives			_____
Students should consult with their college's Program Director or their faculty or academic advisor to select courses that best align with academic and professional goals.			_____
Students should select 0-12 credits from the following list of courses to complete a minimum of 120 total semester credits:		0-12	_____
AIM110	Introduction to Machine Learning		_____
AIM210	Natural Language Processing		_____
AIM220	Artificial Intelligence for Computer Vision		_____
AIM230	Artificial Intelligence for Business Solutions		_____
AIM240	Artificial Intelligence Capstone Project		_____
CIS119DO	Introduction to Oracle: SQL		_____
CIS276DA	MySQL Database		_____
CIS276DB	SQL Server Database		_____
ECE105	MATLAB Programming		_____
MAT240	Calculus with Analytic Geometry III		_____
or MAT241	Calculus with Analytic Geometry III		_____
MAT276	Modern Differential Equations		_____
or MAT277	Modern Differential Equations		_____

Arizona General Education Curriculum-Science (AGEC-S) Requirements

Credits 36 (min)

The AGEC-S requires a minimum of 36 credits (33 if FYC is met by single transfer course)*; courses applied to meet AGEC-S requirements vary by emphasis.

Refer to the program (Degree) Search at curriculum.maricopa.edu (https://curriculum.maricopa.edu/) (click on Current Programs) for specific course requirements. The Required Courses and/or Restricted Electives for some areas of Emphasis may also have AGEC designations including one or more of the Awareness Areas ([C], [G] and/or [H]). A single course may meet more than one requirement but its credits are only counted once toward the total for the degree.

Some courses have been approved for more than one AGEC designation (see AGEC matrix). For the AGEC-S only, a single course with an [L] designation may be used to satisfy a second AGEC requirement (as well as any approved Awareness Areas). Only courses with [L] designations may be shared in this way.

[1] FYC may be met with fewer than 6 credits if student has transfer credit from ASU, NAU or UAZ for a single course that meets FYC in full.

Code	Title	Credits	Semester
First-Year Composition (FYC)			_____
ENG101	First-Year Composition [1]	3	_____
or ENG107	First-Year Composition for ESL		_____
ENG102	First-Year Composition [1]	3	_____
or ENG108	First-Year Composition for ESL		_____
Literacy and Critical Inquiry (L) [2]			_____
Students pursuing AGEC-S and/or AS degree are strongly encouraged to choose an L course that also has HU or SB designation or to use CRE101 or COM225 from the Maricopa Additional Requirements Area to satisfy the L requirement. The L course selected may also have been approved to satisfy one or more Awareness Areas (C, G, H). Thus, a single L course could potentially meet another AGEC requirement as well as one or more Awareness areas. [3]		0-3	_____
Mathematical Applications (MA)			_____
Requires the first semester of calculus courses designed for scientists and engineers (MAT220 or MAT221) or any other MA designated course for which Calculus I is a prerequisite.		4-5	_____

The minimum math requirement for graduation defaults to the lowest base-level math, as identified above. Some emphasis may require higher-level math; refer to curriculum.maricopa.edu (click on Current Programs) to search for specific emphasis math requirements.		_____
Humanities, Arts and Design (HU)		_____
A single course approved for both [L] and [HU] designations may be used to satisfy both requirements. This policy is unique to AGEC-S and to [L] courses. A course approved for both [HU] and [SB] can be counted for one or the other designation, not both. AGEC designations are subject to change. See AGEC matrix for each course's value(s) in the semester it is taken.Physical Geology: Dynamic Earth Lab [5]	6	_____
Social-Behavioral Sciences (SB)		_____
A single course approved for both (L) and (SB) designations may be used to satisfy both requirements. This policy is unique to AGEC-S and to (L) courses. A course approved for both (SB) and (HU) can be counted for one or the other designation, not both. AGEC designations are subject to change. [5]	6	_____
Natural Sciences (SQ/SG)		_____
Students must complete eight (8) credits of General Chemistry, University Physics, General Biology for Majors, or Physical and Historical Geology. Consult specific requirements of university transfer major or associate degree with corresponding emphasis for guidance.		_____
Select one of the following sequences:	8-10	_____
General Chemistry		_____
CHM150 & CHM151LL & CHM152 & CHM152LL — General Chemistry I and General Chemistry I Laboratory and General Chemistry II and General Chemistry II Laboratory		_____
CHM150 & CHM151LL & CHM152AA — General Chemistry I and General Chemistry I Laboratory and General Chemistry II with Lab		_____
CHM151 & 151LL & CHM152 & CHM152LL — General Chemistry I and General Chemistry I Laboratory and General Chemistry II and General Chemistry II Laboratory		_____
CHM151 & 151LL & CHM152AA — General Chemistry I and General Chemistry I Laboratory and General Chemistry II with Lab		_____
CHM150AA & CHM152 & CHM152LL — General Chemistry I with Lab and General Chemistry II and General Chemistry II Laboratory		_____
CHM151AA & CHM152 & CHM152LL — General Chemistry I with Lab and General Chemistry II and General Chemistry II Laboratory		_____
CHM150AA & CHM152AA — General Chemistry I with Lab and General Chemistry II with Lab		_____
CHM151AA & CHM152AA — General Chemistry I with Lab and General Chemistry II with Lab		_____
University Physics		_____

PHY121 & PHY131	University Physics I: Mechanics and University Physics II: Electricity and Magnetism		_____
General Biology for Majors			_____
BIO181 & BIO182	General Biology (Majors) I and General Biology (Majors) II		_____
BIO181 & BIO182XT	General Biology (Majors) I and General Biology (Majors) II		_____
BIO181XT & BIO182	General Biology (Majors) I and General Biology (Majors) II		_____
BIO181XT & BIO182XT	General Biology (Majors) I and General Biology (Majors) II		_____
Physical and Historical Geology			_____
GLG101 & GLG103	Physical Geology: Dynamic Earth Lecture and Physical Geology: Dynamic Earth Lab		_____
or GLG101IN	Physical Geology: Dynamic Earth		_____
and			_____
GLG102 & GLG104	Historical Geology: Primordial to Present Lecture and Historical Geology: Primordial to Present Lab		_____
or GLG102IN	Historical Geology: Primordial to Present		_____
Subject Options - Math/Science			_____
Students should refer to transfer resources, including academic advisement, transfer guides and/or requirements for associate degree with corresponding area of emphasis, to select six (6)-ten (10) additional math and/or science credits that meet requirements for selected major.		6-10	_____
This Math/Science requirement can be met by selecting Mathematics course(s) (MAT) that require Calculus I as a prerequisite and/or Computer Science course(s) (CSC) and/or additional Science courses from the following disciplines: Astronomy, Biology, Botany, Chemistry, Engineering, Environmental Science, Geology, Physical Geography, Physics, Zoology (MCCCD prefixes AST, BIO CHM, ECE, EEE, ENV, GLG, GPH, and/or PHY)			_____
Awareness Areas			_____
Courses may be used to satisfy other AGEC requirements and one or more Awareness Area(s). [6]		0-6	_____
Cultural Diversity in the United States (C)			_____
Global Awareness (G) **OR** Historical Awareness (H)			_____

1 FYC may be met with fewer than 6 credits if student has transfer credit from ASU, NAU or UAZ for a single course that meets FYC in full.

2 0 only if shared with HU or SB

3 Or to use CRE101 College Critical Reading and Critical Thinking or COM225 Public Speaking from the Maricopa Additional Requirements Area to satisfy the (L) requirement.
It may also have been approved to satisfy one or more Awareness Areas ([C], [G], [H]). (AGEC designations are subject to change. See AGEC matrix (https://aztransmac2.asu.edu/cgi-bin/WebObjects/agec.woa/3/wa/agecMatrixReport/?inst=001075) for each course's value(s) in the semester it is taken.)

4 MAT220 Calculus with Analytic Geometry I or MAT221 Calculus with Analytic Geometry I

5 AGEC designations are subject to change. See AGEC matrix (https://aztransmac2.asu.edu/cgi-bin/WebObjects/agec.woa/3/wa/agecMatrixReport/?inst=001075) at aztransmac2.asu.edu/cgi-bin/WebObjects/agec (https://aztransmac2.asu.edu/cgi-bin/WebObjects/agec/) for each course's value(s) in the semester it is taken.

6 See AGEC matrix (https://aztransmac2.asu.edu/cgi-bin/WebObjects/agec.woa/3/wa/agecMatrixReport/?inst=001075) at aztransmac2.asu.edu/cgi-bin/WebObjects/agec (https://aztransmac2.asu.edu/cgi-bin/WebObjects/agec/) for current course values.

AGEC-Area Requirements Descriptions/Definitions

First-Year Composition (FYC)

First-Year Composition courses emphasize skills necessary for college-level expository writing, including correct grammar and punctuation, logical organization of ideas, and identification of supporting documentation.

Literacy and Critical Inquiry [L]

In the [L] course students, typically at the sophomore level, gather, interpret, and evaluate evidence and express their findings in writing or speech. This course includes a series of graded written or spoken formal assignments.

Literacy is defined broadly as communicative competence in written and oral discourse; critical inquiry is defined as the gathering, interpreting, and evaluating of evidence. Building on the proficiency attained in traditional First-Year Composition courses, the Literacy and Critical Inquiry [L] requirement sustains and extends students' ability to thoughtfully use and critically analyze written and/or spoken language.

Mathematical Applications [MA]

The Mathematical Studies requirement is intended to ensure that students have requisite skill in mathematics appropriate for their discipline and can apply mathematical analysis in their chosen fields.

Computer/Statistics/Quantitative Applications [CS]

AGEC-A and AGEC-B require a course that emphasizes the use of statistics, other mathematical methods, computer programming languages and/or software in the interpretation of data and in describing and analyzing quantitative relationships.

Humanities, Arts and Design [HU]

The study of the humanities and the disciplines of art and design deepen awareness of the complexities of the human condition and its diverse histories and cultures. Courses in the humanities are devoted to the production of human thought and imagination, particularly in philosophical, historical, religious and artistic traditions. Courses with an emphasis in fine arts and design are devoted to the study of aesthetic experiences and the processes of artistic creation. They may also feature a design emphasis in which material culture is studied as a product of human thought and imagination.

Social-Behavioral Sciences [SB]

Social-Behavioral Sciences provide scientific methods of inquiry and empirical knowledge about human behavior, both within society and within individuals. This area of emphasis in general education curriculum may include study of such disciplines as anthropology, economics, history, political science, psychology, or sociology. The courses in this area address the challenge of understanding the diverse natures of individuals and cultural groups who live together in a complex and evolving world.

Natural Sciences [SQ/SG]

In addition to an understanding of basic scientific principles and concepts, courses in the Natural Sciences are designed to help students appreciate, from firsthand laboratory and/or field research experience, the nature of science as a process that embraces curiosity, inquiry, testing, and communication to better understand natural phenomena At least one of the two natural science courses must include an introduction to the fundamental behavior of matter and energy in physical or biological systems.

Awareness Areas

Students must satisfy two Awareness areas: Cultural Diversity in the U.S. and either Global Awareness or Historical Awareness. Courses can satisfy other AGEC requirements and one or two Awareness areas simultaneously. Therefore, no additional semester credits are required to satisfy the two Awareness areas provided courses selected are approved for those designations (see AGEC matrix (http://aztransmac2.asu.edu/cgi-bin/WebObjects/agec.woa/1/wa/agecMatrixReport/?inst=001075) at aztransmac2.asu.edu/cgi-bin/WebObjects/agec (https://aztransmac2.asu.edu/cgi-bin/WebObjects/agec/)).

Cultural Diversity in the United States [C]

The contemporary "culture" of the United States involves the complex interplay of many different cultures that exist side by side in various states of harmony and conflict. U.S. history involves the experiences not only of different groups of European immigrants and their descendants, but also of diverse groups of American Indians, Hispanic Americans, African Americans and Asian Americans--all of whom played significant roles in the development of contemporary culture and together shape the future of the United States. At the same time, the recognition that gender, class, and religious differences cut across all distinctions of race and ethnicity offers an even richer variety of perspectives from which to view one. Awareness of cultural diversity and its multiple sources can illuminate the collective past, present, and future and can help to foster greater mutual understanding and respect.

The objective of the Cultural Diversity area requirement is to promote awareness of and appreciation for cultural diversity within the contemporary United States. This is accomplished through the study of the cultural, social, or scientific contributions of women and minority groups, examination of their experiences in the United States, or exploration of successful or unsuccessful interactions between and among cultural groups.

Global Awareness [G]

Human organizations and relationships have evolved from being family and village centered to the modern global interdependence that is apparent in many disciplines--for example, contemporary art, business, engineering, music, and the natural and social sciences. Many serious local and national problems are world issues that require solutions which exhibit mutuality and reciprocity. These problems occur in a wide variety of activities, such as food supply, ecology, health care delivery, language planning, information exchange, economic and social developments, law, technology transfer, and even philosophy and the arts. The Global Awareness Area recognizes the need for an understanding of the values, elements, and social processes of cultures other than the culture of the United States. The Global Awareness Area includes courses that recognize the nature of other contemporary cultures and the relationship of the American cultural system to generic human goals and welfare.

Courses that satisfy the global awareness option in the requirements are of one or more of the following types:

1. Area studies that are concerned with an examination of culture-specific elements of a region of the world;
2. The study of a non-English language;
3. Studies of international relationships, particularly those in which cultural change is facilitated by such factors as social and economic development, education, and the transfer of technology; and
4. Studies of cultural interrelationships of global scope such as the global interdependence produced by problems of world ecology.

Historical Awareness [H]

The Historical Awareness Area option in the requirements aims to develop a knowledge of the past that can be useful in shaping the present and future. Because historical forces and traditions have created modern life and lie just beneath its surface, historical awareness is an aid in the analysis of present-day problems. Also, because the historical past is a source of social and national identity, historical study can produce intercultural understanding by tracing cultural differences to their origins. Even the remote past may have instructive analogies for the present.

The Historical Awareness Area consists of courses that are historical in method and content. In this area, the term "history" designates a sequence of past events or a narrative whose intent or effect is to represent such a sequence.

The requirement presumes that these are human events and that history includes all that has been felt, thought, imagined, said, and done by human beings. History is present in the languages, art, music, literature, philosophy, religion, and the natural sciences, as well as in the social science traditionally called history.