

Submit on blue paper

COURSE / CURRICULUM MODIFICATION REQUESTCOLLEGE **Technology******COURSE CHANGE**

- Create new course
 Eliminate course
 Modify existing course (*mark all that apply*):
- Title Description Prerequisite
 Course content
 Course number (old course number to be deleted)
 Credit Hours Term offered
 Contact Hours
 Method of instruction (*see table on reverse*)
 Web-centric
 Web-based (*definitions on reverse*)

Requested Course change effective date: _____ (Semester/Year)

Implemented by Registrar, effective:

****reviewed by Undergraduate Council if it has broad impact****PROGRAM CHANGE****Program Name:** **Robotics Engineering**

- Minor change to program requirements/checksheet
 Change program name
 *Create new program and new program code (check one):
 degree major minor
 specialization certificate
- *Major change to program requirements/checksheet
 *Program to be available 100% online
 *Add, delete, modify program matriculation requirements
 *Suspend admission to and/or eliminate a program

Requested Program effective date: **fall/2023** (Semester/Year)

Implemented by Registrar, effective:

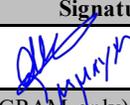
reviewed by Undergraduate Council*CATALOG DESCRIPTION for a new or modified course. OR BRIEF OVERVIEW of program change** (limit 675 characters):

As part of an upcoming restructuring, the College of Technology, Architecture, and Applied Engineering has been approved to develop a School of Engineering that supports the university's strategic plan, FORWARD. The College currently houses one undergraduate engineering program, Systems Engineering, and is working to transition existing engineering technology programs into engineering programs. The proposed change is to transition the current B.S in Mechatronics Engineering Technology program into a B.S. in Robotics Engineering. The transition from engineering technology to engineering requires changes that include renaming the program, updating course content, adding new courses, renaming courses, and adapting existing program learning outcomes to meet standards established by the Engineering Accreditation Commission (EAC) of ABET.

*(If this is a new course or if the "Method of instruction" box is checked above):*Maximum Class Size _____ Grading method: A/F S/U only A/B/C/NC (No Credit) S/NC (No Credit)

Method(s) of Instruction _____ and contact hours _____

See page two for Methods of Instruction definitions and approved combinations*What other colleges or departments/programs may be affected by this proposal? **CTAAE and Art and Science****Please attach comments from affected units and circulate them with the curriculum modification request.**

	Position	Name (print or type)	Signature	Date
1	Proposer Tel: 419- 3728392 Position: Professor	Mohammad Mayyas		4/13/22
ADEQUATE LIBRARY MATERIALS ARE AVAILABLE (For NEW COURSE or NEW PROGRAM only):				
2	Dean, University Libraries			
APPROVED:				
3	Chair or School/Program Director			
4	Chair, College/School Curriculum Committee		 Andreas Luescher (May 23, 2022 15:46 EDT)	
5	Dean of College			
6	Secretary, UGC (<i>major changes only</i>)	Sarah Meussling		
ACTIONS OF UNDERGRADUATE COUNCIL ARE REVIEWED BY THE FACULTY SENATE COMMITTEE ON ACADEMIC AFFAIRS (CAA).			Materials sent to CAA on:	
7	Provost/VPAA	Glenn Davis		
REVIEWED AND IMPLEMENTED BY:				
8	Registrar			

SUBMITTING CURRICULUM MODIFICATION REQUESTS

A complete curriculum modification request includes a cover (blue) sheet and responses to either the “Course Change Request Form” or the “Program Change Request Form,” as appropriate (<http://www.bgsu.edu/provost/undergraduate-education/curriculum-modification-blue-sheets.html>).

The type of change will determine the way the proposal will be routed for approval. Changes that have minimal impact on other programs or on student requirements do not require review by the Undergraduate Council. For instance, “Minor changes to program requirements/checksheet” are those, such as small changes to the list of courses required for a major that have little or no effect on other academic units or on students’ likely academic progress. Please NOTE: The creation of a new course is a “Course Change,” but the addition of a course to program requirements is a “Program Change” requiring a separate blue sheet – neither change requires review by Undergraduate Council.

Any change that has a substantial impact on programs or students will require Undergraduate Council approval. For instance, “Major changes to program requirements/checksheet” are those that involve extensive new patterns of requirements for existing majors and minors (including entrance requirements from pre-major programs), or that have a significant impact on other departments’ programs / student requirements. Similarly, if a course change has wide impact on students in other programs, it will be reviewed by Undergraduate Council. Proposals for new degrees should be prepared in consultation with the office of the Provost/VPAA; they require approval by the Board of Trustees and the Ohio Department of Higher Education (formerly known as the Ohio Board of Regents). The Department of Higher Education new program/degree guidelines are available in the office of the Provost/VPAA. Program changes that include contractual arrangements with other institutions must be reviewed by University Counsel prior to signing. They also require Provost/VPAA approval and may require approval by the Board of Trustees.

CATALOG DESCRIPTION for a new or modified course, OR BRIEF OVERVIEW of other change:

- For requests to introduce or modify a course**, type the new description of the course (limit, 675 characters) exactly as it should appear in the Undergraduate Catalog, including course number, title, credit hours, semesters offered, description, and prerequisites. Indicate contact hours per week associated with primary methods of instruction (e.g., **LE(2)**, **LB(3)**) – see table for brief definitions and approved combinations), class size, and grading method.
- For all other requests**, provide an identifying title for the proposal and a succinct description of the proposed change.

CHECKPOINT PROCEDURES

- All proposals are circulated to the college offices for review (see #3, below). Anticipating that review, the person initiating the proposal should identify any academic units that may have a specific interest in the proposal. During review, the college offices are expected to attach comments from the identified units (and other units, as appropriate). The proposer may speed the process by soliciting comments prior to review by the colleges.
- The Dean of University Libraries must certify that adequate library materials are available for any new course or new program. This may be a time-consuming step, so the proposer is encouraged to begin work with the library while the proposal is in draft form. Following library review and approval by the department chair or school/program director the proposal is forwarded to the dean for transmittal to the college curriculum committee.
- Following review and approval by the curriculum committee and the Dean, the original and any supplemental statements should be submitted to the Office of the Provost/VPAA. All proposals will be circulated to the other colleges by the Secretary of Undergraduate Council. If no objection is raised within 14 days, proposals not requiring review by Undergraduate Council will be transmitted to the Provost/VPAA for approval. All other proposals will be forwarded to Undergraduate Council.

<u>Methods of Instruction (defined by OBR)</u>			
<i>Contact the BGSU Registrar for full descriptions.</i>			
LE	Lecture	DI	Discussion
SE	Seminar	RE	Recitation
LB	Lab	CL	Clinical
PR	Practicum	FE	Field Experience
ST	Studio	IS	Individual Studies
TU	Tutorial	SP	Self-Paced
OT	Other		
Web-centric: Course requires at least one class meeting, but web materials will be used to substitute for at least half of the regularly scheduled class meetings. Extensive use of the web will be required.			
Web-based: 100% online course – students do not meet in a traditional classroom setting.			
<u>Approved Combinations</u>			
LE/LB	Lecture/ Lab	SE/FE	Seminar/ Field Experience
DI/RE	Discussion/ Recitation	TU/SP	Tutorial/ Self-Paced
LE/RE	Lecture/ Recitation	LE/LB	Lecture/Lab/ Recitation
LE/RE/PR	Lecture/Recitation/Practicum		

Modifications to courses cross-listed as graduate courses should be processed simultaneously through the Graduate College.

PROGRAM CHANGE REQUEST FORM

This sheet is an overview of the content and format of proposals for a new undergraduate program, or for elimination or modification of an existing program. Most program changes must be reviewed by Undergraduate Council and, in some cases, by the Board of Trustees and/or the Ohio Board of Regents. As a result, a proposal for program changes should generally be prepared in consultation with the Office of the Senior Vice President for Academic Affairs and Provost. Some of the information in the proposal must be summarized on the COURSE/CURRICULUM MODIFICATION REQUEST cover sheet ("blue sheet") that will accompany it through the approval process. *Depending on the nature of the request, it may not be necessary to provide all the information below. Please use your own responses to the checkbox items on the "blue sheet" as a guide for deciding which items below are relevant to your proposal.* Please use the outline headings shown below to prepare your document; omit any that do not apply.

A. THE MODIFICATION

1. *For all proposals:* Describe briefly the nature of the proposed change.

This is a transition from Mechatronics Engineering Technology to Robotics Engineering. This supports the University's Strategic Plan FORWARD to impact the regional, state, and national needs of engineers to support product development, manufacturing, and logistics. This also supports/aligns our programs to the newly approved College structure with the creation of the School of Engineering.

The curriculum modification process is intended to change program requirements as represented in the Undergraduate Catalog and on checksheets. For this reason, all curriculum modifications for new programs or program revisions must include:

- 1.1 A checksheet that shows and highlights the proposed change(s). (Please make the *changes* on the checksheet *obvious*, preferable with revision markings).
- 1.2 Catalog pages (printed from the current version of the online catalog) showing the proposed changes. (Please use revision markings or some other device to make *changes obvious*). If a new program is being proposed, then new catalog copy should be submitted. Care should be taken to ensure that the proposed changes to the catalog match the proposed changes to the checksheet.

2. List courses to be taken out of program requirements. (If courses are to be eliminated from course inventory, submit a separate "course change" for that action).

N/A - as new transitioned degree

3. List courses to be added to program requirements. (If new courses are to be added to course inventory, submit a separate "course change" for that action).

See the attached check sheet for the list of the course of study.

4. *For proposals to make major changes to program requirements:* Describe any change to the sequence of courses within a major/minor/area of specialization/certificate.

See attached degree plan for the sequence of courses

5. Will this change result in modification of student learning outcomes? yes no
If yes, list all changes to the student learning outcomes related to the curriculum modification and describe the plan for assessing those outcomes.

This program is intended to be accredited by ABET, and the following are expected ABET student outcomes:

1. **an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.**

2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. an ability to communicate effectively with a range of audiences.
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

6. Program changes approved before the January deadline for the Catalog update will be recorded in the Catalog and will be in effect for checksheets in the fall of that year.

B. RATIONALE *[Required for all proposals]:*

1. Reason/Need for the change. For new programs, explain how this fits with the Academic Plan.
This is a transtion from Mechatronics Engineering Technolgoy to Robotics Engineering. This supports the University's Strategic Plan FORWARD to impact the regional, stte, and national needs of engineers to support product development, manufacturing, and logistics. This also supports/aligns our programs to the newly approved College structure with the creation of the School of Engnieering..
2. Student implications (describe the basis for each estimate)
 - 2.1 Prospective demand for a new degree/major/minor (level of student interest).
It is anticipated that there is good demand for the engineering degree programs. A market analysis has been conducted and is included with the proposal.
 - 2.2 Effect on required hours in degree/major/minor.
 - **Program maintains the 122 units required for a Bachelor's Degree at BGSU**
 - 2.3 Number of students affected and in what way.
 - **This will be applied for new coming students, and won't affect the current student population.**
 - 2.4 Effect on elective hours of majors/minors.
This program has a higher number of elective hours to allow for mapping to student interest.
 - **A Robotics minor is also added for non-major students- see Robotics minor proposal attached seperately.**
 - 2.5 If a degree/major/minor is to be eliminated, how will current students in the program be accommodated?
 - **The proposed changes won't affect the currently enrolled students.**
 - 2.6 If requirements for matriculation from a pre-major program are to be added or modified, how will those changes affect student enrollment and progress toward graduation?
No matriculation is included in this degree; formal course pre-reqs will guide students through proper progress toward degree..
 - 2.7 Is this a degree program whose normal time to degree is something other than four calendar years for a baccalaureate degree and two calendar years for an associate degree? If so, how many hours/years to obtain the degree?

This degree program can be completed in four years; see the attached degree plan.

C. IMPLICATIONS FOR EXISTING PROGRAMS *[For all proposals]:*

1. How will the proposed change affect the integrity of other programs to which it is related, including the demand for courses or degrees in other programs

1.1 in the department/school?

It is anticipated that the originating technology degree program, BS-MET, enrollment will decrease and may be phased out as the demand and enrollment in this engineering program increases.

1.2 in the college?

- **Course enrollments will shift from current technology courses to those of engineering courses as new programs roll out**

1.3 in other university departments/colleges?

- **Demand for some MATH and Science courses may increase – communication has occurred and documented.**

1.4 at other universities?

2. What individuals in other departments/schools/colleges, if any, have been consulted about this proposal? *[attach correspondence where appropriate]*

Engineering Technologies Department (Chair and Faculty), Math Department (Math Chair and Faculty), Physics Department (Chair and Faculty), Chemistry Department (Chair and Faculty), Biology Department (Chair and Faculty), Computer Science Department (Chair and Faculty), Economics Department (Chair and Faculty), English Department (Chair and Faculty).

3. What effect will the proposed change have on accreditation of this program or of associated programs in the college/university?

Once ready with the new program, the ABET accreditaion process for general Engineering programs (Robotics Engineering comes under this) will be followed.

4. What effect will the proposed change have on the ability of the department/school/college/university to meet goals for recruitment, retention, and diversity?

- **The enrollment in this engineering degree program is anticipated to be higher than the present technology degree program allowing for recruitment of more students.**

D. STAFFING IMPLICATIONS/QUALIFICATIONS

1. *For new programs, or if an existing degree/major/minor/area of specialization is to be modified:*

Are faculty and staff with expertise available now? yes no

If not, how will they be identified/recruited?

2. *For all proposals:* How will this change affect the allocation of faculty and staff in the department/school/college? **No changes.**

3. *For all proposals:* How will this change affect faculty work load? **No changes.**

E. AVAILABILITY OF RESOURCES

1. *For all proposals:* Indicate any unique space requirements for new or modified curricula, and space likely to be released by the elimination or modification of existing curricula, and space likely to be released by the elimination or modification of existing curricula.

No changes needed. The Robotics lab can provide supporting equipment for the proposed courses.

2. *For all proposals:* Indicate any new one-time or continuing costs for materials, equipment, services, or personnel directly associated with a new or modified curriculum. How will these costs be covered? Indicate any cost savings to be generated if an existing degree/major/minor/area of specialization is to be eliminated.

No changes.

3. *For all programs, or if an existing degree/major/minor/area of specialization to be modified:* Indicate any unique library, computer, or instructional media resources that will be needed for new or modified curricula. Are they already available?

The Robotics program faculty members have been securing instructional media resources such as software licenses, computers and other additional resources required to balance between the hands on and theoretical learning activities - Software needs (e.g., MATLAB/Simulation software currently available via ITS/BGSU.

IEEE Journal access will be needed

F. TIMETABLE FOR IMPLEMENTATION [*For all proposals*]

1. Provide a detailed timetable for events that will occur as the proposed program change is accomplished (e.g. addition or elimination of courses, hiring of faculty).

Pending overall approval – implementation will be intentional to allow for recent students to enter transitioned program should they choose and then have new students enter as they initially enroll at BGSU. Students in existing engineering technology program will be supported fully to complete in progress degree program.

G. OTHER INFORMATION

1. Provide other information that may be helpful in the review process, as appropriate.

See attached packet for current and proposed checksheets, new program blue sheets, and support e-mails and additional supporting documents.

Mechatronics Engineering Technology

BG PERSPECTIVE (BGP) REQUIREMENTS:

Course _____ Credits _____

Must complete at least 1 course in each of the following:

English Composition and Oral Communication

Quantitative Literacy

Must complete at least 2 courses in each of the following:

Humanities and the Arts

Natural Sciences - at least one Lab Science required

Social and Behavioral Sciences

Complete total required BGP credit hours by selecting courses from any of the above categories:

UNIVERSITY REQUIREMENTS

Note: Designated courses in the Humanities and the Arts, and the Social and Behavioral Sciences domains may be used to fulfill both a BGP requirement and one of the following university requirements:

Cultural Diversity in the U.S. _____

International Perspective _____

Composition Requirement:

_____ WRIT 1120 Research Writing _____

Total BGP Credits: Must be at least 36

+ These must be in the management/business area.

** These courses may be used to meet BG Perspective requirements, but hours are counted only once.

See the Undergraduate Catalog, www.bgsu.edu/catalog

NOTES:

- Due to the cooperative education requirement, in order to complete this program in four years, it is necessary for the student to either enroll in co-op hours or coursework during the summer as well as during the academic year. If a student is not able to do so, this program will take five years to complete.

Courses Required for Major

Cooperative Education

_____	TECH 2890 Co-op	2 Hrs
_____	TECH 3890 Co-op	1

Concentration

_____	ROBO 1010 Sensors & Actuators	54 Hrs
_____	ROBO 2080 Industrial Robotics & Automation	3
_____	ROBO 4500 Senior Design Project	3
_____	ECET 2400 Electric Circuits	3
_____	ECET 2410 Electronic Circuits	3
_____	ECET 2490 Dig Elec Comp & Sys (prereq ECET 1960)	3
_____	ECET 3000 Electrical Machinery	3
_____	ECET 3100 Prog Logic Controllers	3
_____	ECET 3490 Digital Computer Analysis	3
_____	ENGT 1100 Computer Aided Design	3
_____	ENGT 2100 Solid Modeling	3
_____	ENGT 2200 Met Mtl's & Proc	3
_____	ENGT 2400 Statics	3
_____	ENGT 2480 Dynamics	3
_____	ENGT 3480 Thermodynamics	3
_____	QS 3550 Foundations of Lean OR	3
_____	QS 3710 Six Sigma Systems	3
_____	QS 4850 Quantitative Tools for Qual & Cont Impr	3
_____	SYE 2010 Eng. Economics	3

Other Required Courses

_____	CS 2010	41-42Hrs
_____	ECON 2000**	3
_____	ENG 3880	3
_____	COMM 1020**	3
_____	MATH 1280**	5
_____	MATH 1310** OR MATH 1340** AND 1350	5-6
_____	MATH 2470	3
_____	MATH 2910	3
_____	PHYS 2010**	5
_____	PHYS 2020**	5
_____	TECH 3020	3

Technical Electives - By Advisement

_____	ECET 1960	9-10 Hrs
_____	ECET 4410	3
_____	ECET 4530	3
_____	ENGT 2450	3
_____	ENGT 4000	3
_____	TECH 4400	3
_____	TECH 4890	1

Non-Technical Electives

_____	Choose any non-technical electives	6 Hrs
		3

Total Minimum Program Hours

122 Hrs

Important information on the back.

<p>BG PERSPECTIVE (BGP) Requirements: Course Credits Must complete at least 1 course in each of the following: English Composition and Oral Communication _____ Quantitative Literacy _____ Must complete at least 2 courses in each of the following: Humanities and the Arts _____ Natural Sciences - at least one Lab Science required _____ Social and Behavioral Sciences _____ Complete total required BGP credit hours by selecting courses from any of the above categories: _____ _____ _____ UNIVERSITY REQUIREMENTS Note: Designated courses in the Humanities and the Arts, and the Social and Behavioral Sciences domains may be used to fulfill both a BGP requirement and one of the following university requirements: Cultural Diversity in the U.S.: _____ International Perspective: _____ WRIT 1120 Research Writing _____ Total BGP Credits: Must be at least 36 ** These courses may be used to meet BG Perspective requirements, but hours are counted only once. #See the Undergraduate Catalog, www.bgsu.edu/catalog TECH 4890 can be used as an elective.</p>	<p style="text-align: center;"><u>Courses Required for Major</u></p> <p><u>Cooperative Education</u> _____ TECH 2890 Co-op _____ TECH 3890 Co-op</p> <p><u>General Engineering Courses</u> _____ ECE 2405 Electric Circuits and Devices _____ ECE 2495 Digital logic circuits _____ ECE 3535 Linear Control Systems _____ MME 1100 Computer Aided Design _____ MME 2400 Statics _____ MME 2480 Dynamics _____ MME 3480 Thermodynamics _____ SYE 2010 Engineering Economics</p> <p><u>Non-Engineering Required Courses</u> _____ COMM 1020** Introduction to Public Speaking _____ ECON 2000 Introduction to Economics OR ECON 2020 Principles of Microeconomics _____ TECH 3020 Technology systems in Societies _____ CS 1010 Introduction to Python Programming _____ CS 2010 Programming Fundamental _____ BIOL 1040 Introduction to Biology OR CHEM 1090 Elementary Chemistry AND CHEM 1100 Elem Chemistry Lab _____ PHYS 2110** University physics I _____ PHYS 2120** University physics II _____ MATH 1310**Calculus and Analytic Geometry OR MATH 1340**Calculus and Analytic Geometry IA & MATH 1350** Calculus and Analytic Geometry IB _____ MATH 2320 Calculus and Analytical Geometry II _____ MATH 2470 Fundamental of Statistics _____ MATH 2910 Applied Engineering Mathematics with Applications</p> <p><u>Robotics Major Courses</u> _____ ROBO 1010 Sensors & Actuators _____ ROBO 2080 Industrial Robotics and Automation _____ ROBO 3131 Introduction to Robotics _____ ROBO 3210 System Dynamics _____ ROBO 3232 Robot Operating Systems _____ ROBO 4130 Robotic Control Systems _____ ROBO 4231 Machine Vision in Robotics _____ ROBO 4230 Machine Learning for Autonomous Systems _____ ROBO 4500 Senior Design Project _____ ROBO 3133 Microfab. and Semiconductor Processes</p> <p><u>Electives (Choose any)</u> _____ ROBO 3032 Biomedical Device Technology _____ ROBO 4031 Topics in Applied Robotics Engineering _____ ROBO 4033 MEMS Finite Element Analysis _____ ECE 2415 Analog Electronics _____ ECE 3105 Programmable Logic Controllers _____ QS 3550 Lean Systems _____ ENG 3880 Introductory Technical Writing _____ TECH 4400 Project Management in Tech. Settings _____ TECH 4890 Co-op</p> <p>Total Minimum Program Hours</p>	<p><u>2 Hrs</u> 1 1 <u>24 Hrs</u> 3 3 3 3 3 3 3 <u>45-46Hrs</u> 3 3 3 3 3 3 4 5 5 5-6 5 3 3 <u>30Hrs</u> 3 3 <u>12 Hrs</u> 3 3 3 3 3 3 3 3 3 1 <u>122Hrs</u></p>
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Sample Four Year Degree Plan

BS in Robotics Engineering – Fall 2023 Requirements

This is not an official graduation plan but a tool to use along with your audit and check sheet

Assuming placement in: MATH 1310 and WRIT 1120

<p align="center">Year 1 - Fall Semester</p> <p>CS 1010 3 MATH 1310 5 PHYS 2110 5 WRIT 1120 3</p> <p align="right">Total hrs. 16</p>	<p align="center">Year 1 – Spring Semester</p> <p>CS 2010 3 MME 1100 3 MATH 2320 5 PHYS 2120 5</p> <p align="right">Total hrs. 16</p>	<p align="center">Year 1 – Summer Session</p> <p>TECH 2890 1</p> <p align="right">Total hrs. 1</p>
<p align="center">Year 2 - Fall Semester</p> <p>ECE 2405 3 MME 2400 <i>fall only</i> 3 ROBO 1010 <i>fall only</i> 3 ECON 2000 <i>OR</i> 2020 3 CHEM 1090+1100 <i>OR</i> BIOL 1040 4</p> <p align="right">Total hrs. 16</p>	<p align="center">Year 2 – Spring Semester</p> <p>MME 2480 <i>spring only</i> 3 ECE 2495 3 ROBO 2080 <i>spring only</i> 3 MATH 2910 3 COMM 1020 3</p> <p align="right">Total hrs. 15</p>	<p align="center">Year 2 – Summer Session</p> <p>TECH 3890 1</p> <p align="right">Total hrs. 1</p>
<p align="center">Year 3 - Fall Semester</p> <p>ROBO 3131 2800 3 MATH 2470 3 SYE 2010 3 MME 3480 3 ROBO 3133 3</p> <p align="right">Total hrs. 15</p>	<p align="center">Year 3 – Spring Semester</p> <p>ROBO 3210 3 ECE 3535 3 ROBO 3232 3 Elective 3 BGP H-A 3</p> <p align="right">Total hrs. 15</p>	<p align="center">Year 3 – Summer Session</p>
<p align="center">Year 4 - Fall Semester</p> <p>ROBO 4130 3 Elective <i>fall & spring</i> 3 Elective <i>fall & spring</i> 3 TECH 3020 <i>fall & spring</i> 3 BGP H&A + Cultural Div. 3</p> <p align="right">Total hrs. 15</p>	<p align="center">Year 4 – Spring Semester</p> <p>ROBO 4230 3 ROBO 4231 3 ROBO 4500 3 Elective 3</p> <p align="right">Total hrs. 12</p>	

Robotics Engineering program outcomes and assessment plan:

No	Outcome	Course contributing to outcome
1	An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.	ROBO 3210 ROBO 4130 ROBO 4230 ROBO 4231
2	An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.	ROBO 4130 ROBO 4230 ROBO 4231
3	An ability to communicate effectively with a range of audiences	ROBO 4500
4	An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.	ROBO 3133 ROBO 3032
5	An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.	ROBO 4500
6	An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.	ROBO 4130 ROBO 4230 ROBO 4231
7	An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.	ROBO 3133

Request to Add BIOL

From: [Juan Luis Bouzat](#)
To: [Mohammad A Mayyas](#)
Subject: RE: Request to add BIOL1040
Date: Thursday, March 3, 2022 5:11:01 PM

Thanks Mohammad,
No problem form Biology.
Regards,

Juan

***Get vaccinated, wear your mask, and wash your hands.
Let's flatten the curve!***

Juan L. Bouzat, Ph.D.

Professor and Chair

Department of Biological Sciences
Evolutionary and Conservation Genetics
Bowling Green State University
Bowling Green, OH 43403
www.bgsu.edu/arts-and-sciences/biological-sciences.html

From: Mohammad A Mayyas <mmayyas@bgsu.edu>
Sent: Thursday, March 3, 2022 12:28 PM
To: Juan Luis Bouzat <jbouzat@bgsu.edu>; Resmi Krishnankuttyrema <resmik@bgsu.edu>; Mohammed Ibrahim Kmal Abouheaf <mabouhe@bgsu.edu>; MD Baniamin Sarder <msarder@bgsu.edu>; Linda Leimgruber <lleimgr@bgsu.edu>
Subject: RE: Request to add BIOL1040

Juan,

We will have on average 25 students per year, but the demand is expected to increase. The other two CHEM courses were switched into (CHEM 1090 and 1100). While students can take both because there are non-Tech electives, we are offering elective courses that require that have either CHEM or BIOL as prerequisite. Our elective course ROBO Biomedical device Technology will need elementary biology background. Our elective course ROBO Microfabrication and semiconductor processes, will require elementary courses in chemistry.

Hope this answer your questions, we look forward for your support.

Best Regards
Mohammad

From: Juan Luis Bouzat

Sent: Thursday, March 3, 2022 10:27 AM

To: Mohammad A Mayyas <mmayyas@bgsu.edu>

Subject: RE: Request to add BIOL1040

Hi Mohammad,

In principle, we will not have any problem, as any non-bio major can take this course.

A couple of questions though:

1. Can you please tell me how the requirements look in the current sheet?
2. It seems that students will likely choose the BIOL alternative (4ch) versus the TWO CHEMS (TOTAL OF 5 ch).

Please, also let me know:

How many Mechatronics Engineering Technology students are enrolled in your program?

Thanks

Juan

***Get vaccinated, wear your mask, and wash your hands.
Let's flatten the curve!***

Juan L. Bouzat, Ph.D.

Professor and Chair

Department of Biological Sciences

Evolutionary and Conservation Genetics

Bowling Green State University

Bowling Green, OH 43403

www.bgsu.edu/arts-and-sciences/biological-sciences.html

From: Mohammad A Mayyas <mmayyas@bgsu.edu>

Sent: Wednesday, March 2, 2022 5:55 PM

To: Juan Luis Bouzat <jbouzat@bgsu.edu>

Cc: Mohammed Ibrahim Kmal Abouheaf <mabouhe@bgsu.edu>; Resmi Krishnankuttyrema <resmik@bgsu.edu>; MD Baniamin Sarder <msarder@bgsu.edu>

Subject: Re: Request to add BIOL1040

Dr. Bouzat,

I failed to mention that we would like to have your decision before March 15. We have a deadline to submit the support letters to the undergraduate college council by that time.

Thanks you for understanding and for supporting our proposal in advance.

Linda,

Could you please follow up with the biology department if needed.

Best regards

Mohammad

On Feb 28, 2022, at 3:14 PM, Mohammad A Mayyas <mmayyas@bgsu.edu> wrote:

Dr. Bouzat, the Chair of the Department of Biological Sciences

The Mechatronics Engineering Technology is undergoing changes to its curriculum requirements. We would like to give our student an option to take (BIOL 1040 Introduction to Biology) or (CHEM 1230 General Chemistry I **AND** CHEM 1240 General Chemistry I Laboratory) . This change in the degree requirement will show in our check-sheet as follow

BIOL 1040 Introduction to Biology **OR**
CHEM 1230 General Chemistry I **AND**
CHEM 1240 General Chemistry I Laboratory

We seek your acknowledgment and support for this change, specifically to adding BIOL 1040, which is planned to take an effect after Fall 2023.

Best Regards

Mohammad Mayyas, Ph.D
Professor
Mechatronics Engineering Technology, Founder and Program Director
Robotics Facility, PI
[Bowling Green State University](http://www.bgsu.edu/robotics)
www.bgsu.edu/robotics
mmayyas@bgsu.edu

Request to Add CHEM

From: [John R Cable](#)
To: [Mohammad A Mayyas](#)
Subject: Re: Request to add CHEM 1230 and 1240
Date: Thursday, March 3, 2022 2:43:04 PM

Sounds, good. What would you like me to provide in the way of support? Is an email OK?
John

On Mar 3, 2022, at 10:50 AM, Mohammad A Mayyas <mmayyas@bgsu.edu> wrote:

Dr. Cable,
Thank you for clarification and suggestions. Based on your recommendation, we will add (CHEM Elementary Chemistry 1090 **AND** CHEM 1100 Elementary Chemistry Laboratory) instead of our previous request (CHEM 1230 General Chemistry I **AND**, CHEM 1240 General Chemistry I Laboratory).

Kindly, we look forward for your support.

Best Regards- Mohammad

From: John R Cable
Sent: Thursday, March 3, 2022 10:17 AM
To: Mohammad A Mayyas <mmayyas@bgsu.edu>
Cc: Resmi Krishnankuttyrema <resmik@bgsu.edu>; MD Baniamin Sarder <msarder@bgsu.edu>; Linda Leimgruber <lleimgr@bgsu.edu>
Subject: Re: Request to add CHEM 1230 and 1240

Mohammed,

Thanks for the enrollment estimate.

My point was that the general chemistry course you selected is not really an “introductory” course. It’s the first course in the chemistry major and is really meant to be part of a two course sequence.

CHEM 1090 and 1100 (Elementary Chemistry, BGP approved) is a 1 semester combination of lecture+lab courses that are meant to introduce students to most of the topics covered in the full General Chemistry sequence (CHEM 1230, 1240, 1270, and 1280) but with somewhat less depth. For students whose major requirements allow only a one-semester chemistry experience, we would recommend CHEM 1090 and 1100.

I think this distinction is similar to that of biology, where majors take the two semesters of BIOL 2040 and 2050 while students wanting a 1-semester intro take BIOL 1040.

John

On Mar 2, 2022, at 6:23 PM, Mohammad A Mayyas
<mmayyas@bgsu.edu> wrote:

John ,
We expect the annual enrollment in chemistry to start with an average of 25 students per year.

The introductory course in chemistry or biology will have several benefits beside meeting the university BGP course.
robotics program is proposing elective courses in medical device technology or assistive technology, which require some understanding of biology.

semiconductor and micro fab process needs introductory chemistry background.

Hope this answer your questions.
Thanks

Mohammad

On Mar 2, 2022, at 5:33 PM, John R Cable
<cable@bgsu.edu> wrote:

Mohammed,

A first question - How many many students do you anticipate will pursue the chemistry option.

A second question - What is the rationale for selecting CHEM 1230/1240 as the chemistry course? This lecture+lab represents the first semester of what is really designed to be a two-semester sequence. I don't know of any other majors that require only the first semester of general chemistry. Also, for the biology option you've selected a one semester intro/overview course rather than the 1st semester of their standard 2 semester biology sequence (BIOL 2040 and

2050). So there seems to be some inconsistency.

John

John Cable, Chair
Department of Chemistry
Bowling Green State University

On Mar 2, 2022, at 5:21 PM, Mohammad A
Mayyas <mmayyas@bgsu.edu> wrote:

Dr. cable

I failed to mention that we would like to have your decision before March 15. We have a deadline to submit the support letters to the undergraduate college council by that time.

Thanks you for understanding and for supporting our proposal in advance.

Linda,
Could you please follow up with the chemistry department if needed.

Best regards

Mohammad

On Feb 28, 2022, at 3:14 PM,
Mohammad A Mayyas
<mmayyas@bgsu.edu> wrote:

Dr. Cable, the Chair of the
Department Chemistry,

The Mechatronics
Engineering Technology is
undergoing changes to its

curriculum requirements. We would like to give our student an option to take (CHEM 1230 General Chemistry I **AND** CHEM 1240 General Chemistry I Laboratory) or (BIOL 1040 Introduction to Biology). This change in the degree requirement will show in our check-sheet as follow

BIOL 1040
Introduction to Biology
OR
CHEM 1230 General
Chemistry I **AND**
CHEM 1240 General
Chemistry I
Laboratory

We seek your acknowledgment and support for this change, specifically to adding CHEM 1230 and CHEM 1240, which is planned to take an effect after Fall 2023.

Best Regards

Mohammad Mayyas, Ph.D
Professor
Mechatronics Engineering Technology,
Founder and Program Director
Robotics Facility, PI
Bowling Green State University
www.bgsu.edu/robotics
mmayyas@bgsu.edu

Request to Add CS

From: [Jong Kwan Jake Lee](#)
To: [Mohammad A Mayyas](#)
Cc: [Mohammed Ibrahim Kmal Abouheaf](#); [Resmi Krishnankuttyrema](#); [MD Baniamin Sarder](#); [Mohammed Ibrahim Kmal Abouheaf](#)
Subject: RE: Request to add CS1010
Date: Thursday, March 3, 2022 5:33:04 PM

I got responses from most of the committee.

I would be able to send the letter, hopefully tomorrow, but if not, early next week.

Jake



Jong Kwan “Jake” Lee, Ph.D. (he/him/his)
Fulton Associate Professor and Chair
[Department of Computer Science](#),
Bowling Green State University
223 Hayes Hall
Bowling Green, OH 43403
Office: 419.372.2407, Email: leej@bgsu.edu

From: Mohammad A Mayyas
Sent: Thursday, March 3, 2022 5:32 PM
To: Jong Kwan Jake Lee <leej@bgsu.edu>
Cc: Mohammed Ibrahim Kmal Abouheaf <mabouhe@bgsu.edu>; Resmi Krishnankuttyrema <resmik@bgsu.edu>; MD Baniamin Sarder <msarder@bgsu.edu>; Mohammed Ibrahim Kmal Abouheaf <mabouhe@bgsu.edu>
Subject: RE: Request to add CS1010

Hi Jake,

We have deadline to meet right after the spring break. Could you please discuss the proposal with the committee at your earliest convenience, and get back to us no later than March 14.

Best Regards

Mohammad

From: Mohammad A Mayyas
Sent: Monday, February 28, 2022 4:13 PM
To: Jong Kwan Jake Lee <leej@bgsu.edu>
Cc: Mohammed Ibrahim Kmal Abouheaf <mabouhe@bgsu.edu>; Resmi Krishnankuttyrema <resmik@bgsu.edu>; MD Baniamin Sarder <msarder@bgsu.edu>
Subject: RE: Request to add CS1010

Hi Jake,

Yes, I want the students to be able to program in Python, a pre-request for learning robotics operating systems course.

Thanks

From: Jong Kwan Jake Lee

Sent: Monday, February 28, 2022 3:56 PM

To: Mohammad A Mayyas <mmayyas@bgsu.edu>

Cc: Mohammed Ibrahim Kmal Abouheaf <mabouhe@bgsu.edu>; Resmi Krishnankuttyrema <resmik@bgsu.edu>; MD Baniamin Sarder <msarder@bgsu.edu>

Subject: RE: Request to add CS1010

Thanks.

I will get a quick feedback from our Executive Committee and provide the letter.

(I don't see much problem coming.)

But on a quick note/comment, CS 1010 and CS 2010 are very similar courses.

The contents are almost the same except the programming languages are different (i.e., CS 2010 in C++, CS 1010 in Python).

So by requiring these two, they will practice "programming" in two different languages, but their "skills" in "programming" will not gain much.

(My guess is you want to have them exposed to more programming courses including Python.)

So I am just providing a quick feedback for your reference.

If you want to consider other options, maybe some other alternatives are:

- CS 1310 Cybersecurity for Beginners
- CS 2020 Intermediate Programming (i.e., C++ course after CS 2010)
- CS 2190 Computer Organization

These are just your reference.

Jake



Jong Kwan "Jake" Lee, Ph.D. (he/him/his)

Fulton Associate Professor and Chair

[Department of Computer Science](#),

Bowling Green State University

223 Hayes Hall

Bowling Green, OH 43403

Office: 419.372.2407, Email: leej@bgsu.edu

From: Mohammad A Mayyas

Sent: Monday, February 28, 2022 3:32 PM

To: Jong Kwan Jake Lee <leej@bgsu.edu>

Cc: Mohammed Ibrahim Kmal Abouheaf <mabouhe@bgsu.edu>; Resmi Krishnankuttyrema <resmik@bgsu.edu>; MD Baniamin Sarder <msarder@bgsu.edu>

Subject: RE: Request to add CS1010

Hi Jake

The check-sheet final format is not complete, but we finalized the following section that concerns your course.

Non-Engineering Required Courses

- ___ WRIT 1120 - Seminar in Research Writing **Or**
- ___ ENG 3880 Introductory Technical Writing
- ___ COMM 1020** Introduction to Public Speaking
- ___ ECON 2000 Introduction to Economics **Or** ECON 2020 Principles of Microeconomics
- ___ TECH 3020 Technology systems in Societies
- ___ CS 2010 Programming Fundamental
- ___ CS 1010 Introduction to Python Programming
- ___ BIOL 1040 Introduction to Biology **OR**
- CHEM 1230 General Chemistry I **AND**
- CHEM 1240 General Chemistry I Laboratory
- ___ PHYS 2110** University physics I
- ___ PHYS 2120** University physics II
- ___ MATH 1310**Calculus and Analytic Geometry **OR** MATH 1340**Calculus and Analytic Geometry IA & MATH 1350 Calculus and Analytic Geometry IB
- ___ MATH 2320 Calculus and Analytical Geometry II
- ___ MATH 2470 Fundamental of Statistics
- ___ MATH 2910 Applied Engineering Mathematics with Applications

The expected enrollment for CS1010 will be the same for CS 2010. On average, we have 25 students per year who would be taking CS 1010.

Thanks
Mohammad

From: Jong Kwan

Jake Lee

Sent: Monday, February 28, 2022 3:23 PM

To: Mohammad A Mayyas <mmayyas@bgsu.edu>

Cc: Mohammed Ibrahim Kmal Abouheaf <mabouhe@bgsu.edu>; Resmi Krishnankuttyrema <resmik@bgsu.edu>; MD Baniamin Sarder <msarder@bgsu.edu>

Subject: RE: Request to add CS1010

Hi Mohammad,

Thank you for reaching out.

Can you share the new checksheet with CS 1010 in it?

Also, can you also tell me the expected enrollment in CS 1010 from MET program?

When do you need the support letter by?

Thanks,

Jake



Jong Kwan “Jake” Lee, Ph.D. (he/him/his)
Fulton Associate Professor and Chair
Department of Computer Science,
Bowling Green State University
223 Hayes Hall
Bowling Green, OH 43403
Office: 419.372.2407, Email: leej@bgsu.edu

From: Mohammad A Mayyas

Sent: Monday, February 28, 2022 3:15 PM

To: Jong Kwan Jake Lee <leej@bgsu.edu>

Cc: Mohammed Ibrahim Kmal Abouheaf <mabouhe@bgsu.edu>; Resmi Krishnankuttyrema <resmik@bgsu.edu>; MD Baniamin Sarder <msarder@bgsu.edu>

Subject: Request to add CS1010

Dr. Kwan, the Chair of Department of Computer Science

The Mechatronics Engineering Technology is undergoing changes to its curriculum requirements and would like to add (CS 1010 Introduction to Python) to its check-sheet as a degree requirement.

We seek your acknowledgment and support for this change, which is planned to take an effect after Fall 2023.

Best Regards

Mohammad Mayyas, Ph.D

Professor

Mechatronics Engineering Technology, Founder and Program Director

Robotics Facility, PI

Bowling Green State University

www.bgsu.edu/robotics

mmayyas@bgsu.edu

Request to Add ECON

From: [Mohammad A Mayyas](#)
To: [Peter G Vanderhart](#)
Cc: [MD Baniamin Sarder](#); [Mohammed Ibrahim Kmal Abouheaf](#); [Resmi Krishnankuttyrema](#)
Subject: RE: Request to Add ECON 2020
Date: Tuesday, March 1, 2022 5:27:00 PM

Pete,

This is great . I appreciate you working with us on these changes.

Best Regards

Mohammad

From: Peter G Vanderhart
Sent: Tuesday, March 1, 2022 10:28 AM
To: Mohammad A Mayyas <mmayyas@bgsu.edu>
Subject: RE: Request to Add ECON 2020

Mohammad

My curriculum committee has no problem with this. So I fully support the change.

Is this email sufficient, or do you need something more formal?

Pete

From: Mohammad A Mayyas <mmayyas@bgsu.edu>
Sent: Monday, February 28, 2022 3:25 PM
To: Peter G Vanderhart <pvander@bgsu.edu>
Cc: Mohammed Ibrahim Kmal Abouheaf <mabouhe@bgsu.edu>; Resmi Krishnankuttyrema <resmik@bgsu.edu>; MD Baniamin Sarder <msarder@bgsu.edu>
Subject: RE: Request to Add ECON 2020

Pete,

Thank you for prompt response. I would say 20% of the student population may want to take ECON 2020 if they don't want to be in ECON 2000 waiting list. Is it possible to get sooner than Friday as my program faculty trying to meet UPC deadline.

Best Regards

Mohammad

From: Peter G Vanderhart
Sent: Monday, February 28, 2022 3:18 PM
To: Mohammad A Mayyas <mmayyas@bgsu.edu>

Cc: Mohammed Ibrahim Kmal Abouheaf <mabouhe@bgsu.edu>; Resmi Krishnankuttyrema <resmik@bgsu.edu>; MD Baniamin Sarder <msarder@bgsu.edu>
Subject: RE: Request to Add ECON 2020

Mohammad,

I don't see a problem with this, but before I officially support the change, let me run it past my curriculum committee. Is it OK if I get back to you by Friday?

Also, how many students each term would you say would move from 2000 to 2020?

Pete

From: Mohammad A Mayyas <mmayyas@bgsu.edu>
Sent: Monday, February 28, 2022 3:15 PM
To: Peter G Vanderhart <pvander@bgsu.edu>
Cc: Mohammed Ibrahim Kmal Abouheaf <mabouhe@bgsu.edu>; Resmi Krishnankuttyrema <resmik@bgsu.edu>; MD Baniamin Sarder <msarder@bgsu.edu>
Subject: Request to Add ECON 2020

Dr. VanderHart , the Chair of Economics Department

The Mechatronics Engineering Technology is undergoing changes to its curriculum requirements. Currently we require our students to take (ECON 2000 Introduction to Economics). We would like to give them option to take (ECON 2020 Principles of Microeconomics). This change in the degree requirement will show in our check-sheet as follow

ECON 2000 Introduction to Economics OR
ECON 2020 Principles of Microeconomics

We seek your acknowledgment and support for this change, which is planned to take an effect after Fall 2023.

Best Regards

Mohammad Mayyas, Ph.D
Professor
Mechatronics Engineering Technology, Founder and Program Director
Robotics Facility, PI
Bowling Green State University

Request to Add WRIT

From: [Tiffany Beth Scarola](#)
To: [Mohammad A Mayyas](#); [Stephannie S Gearhart](#)
Cc: [Mohammed Ibrahim Kmal Abouheaf](#); [Resmi Krishnankuttyrema](#); [MD Baniamin Sarder](#)
Subject: RE: Request to Add WRIT 1120
Date: Thursday, March 3, 2022 8:47:38 AM

Mohammad,

I have reviewed your request and sent the information to the director for STC—Jennifer Warnke. She and I are in agreement that the WRIT 1120 and ENG 3880 do not fulfill the same requirements and that both 1120 and 3880 need to be in your revised curriculum.

I will pass this request on to the members of the English Undergraduate Committee for a formal discussion and vote, but that will not be until March 16th.

Please feel free to contact me with any additional questions.

Sincerely,

Tiffany

From: Mohammad A Mayyas <mmayyas@bgsu.edu>
Sent: Wednesday, March 2, 2022 5:13 PM
To: Stephannie S Gearhart <stephsg@bgsu.edu>
Cc: Mohammed Ibrahim Kmal Abouheaf <mabouhe@bgsu.edu>; Resmi Krishnankuttyrema <resmik@bgsu.edu>; MD Baniamin Sarder <msarder@bgsu.edu>; Tiffany Beth Scarola <tscarol@bgsu.edu>
Subject: Re: Request to Add WRIT 1120

Drs Gearhart and Scarola

Thank you for getting back to us promptly. I failed to mention that we would like to have your decision before March 15. This is because we have a deadline to submit the support letters to the undergraduate college council.

Thanks you for understanding and for supporting our proposal in advance.

Best regards - Mohammad

On Mar 2, 2022, at 4:01 PM, Stephannie S Gearhart <stephsg@bgsu.edu> wrote:

Dear Professor Mayyas,

Thank you for being in touch regarding the change in your degree requirement. I

am copying our Associate Chair, Tiffany Scarola, who will be able to speak to the effects this change might have on our offerings.

Tiffany, you and I can talk more about this and you can take it to the next meeting of the Undergraduate Committee for their review, and then we will back to Dr. Mayyas.

Thank you again, and I'll be back with you soon.

Best,
Stephannie

Dr. Stephannie S. Gearhart (she/her/hers)
Professor and Acting Chair
Department of English
324/213 East Hall
Bowling Green State University
Bowling Green, Ohio 43403
419 372 6841/7540
stephsg@bgsu.edu
Zoom Office: <https://bgsu-edu.zoom.us/my/stephanniesg>

From: Mohammad A Mayyas <mmayyas@bgsu.edu>
Sent: Monday, February 28, 2022 3:14 PM
To: Stephannie S Gearhart <stephsg@bgsu.edu>
Cc: Mohammed Ibrahim Kmal Abouheaf <mabouhe@bgsu.edu>; Resmi Krishnankuttyrema <resmik@bgsu.edu>; MD Baniamin Sarder <msarder@bgsu.edu>
Subject: Request to Add WRIT 1120

Dr. Gearhart, the Chair of English Department

The Mechatronics Engineering Technology is undergoing changes to its curriculum requirements. Currently we require our students to take (ENG 3880 Introductory Technical Writing). We would like to give them option to take (WRIT 1120 - Seminar in Research Writing). This change in the degree requirement will show in our check-sheet as follow

____ WRIT 1120 - Seminar in Research Writing **OR**
____ ENG 3880 Introductory Technical Writing

We seek your acknowledgment and support for this change, which is planned to take an effect after Fall 2023.
Best Regards

Mohammad Mayyas, Ph.D
Professor
Mechatronics Engineering Technology, Founder and Program Director
Robotics Facility, PI
Bowling Green State University
www.bgsu.edu/robotics
mmayyas@bgsu.edu

Request to Add/Remove Math

From: [Junfeng Shang](#)
To: [Mohammad A Mayyas](#)
Cc: [Mohammed Ibrahim Kmal Abouheaf](#); [Resmi Krishnankuttyrema](#); [MD Baniamin Sarder](#); [Linda Leimgruber](#); [Jennie Gallimore](#)
Subject: Re: Request to Add/remove Math courses
Date: Wednesday, March 16, 2022 3:18:52 PM
Attachments: [Outlook-bw0ustuc.png](#)
[Outlook-2iwp3cfs.png](#)
[Outlook-5pgbbzsj.png](#)

Hi Mohammad,

We discussed your request in our departmental advisory committee meeting today.

Yes, Math department is fine with adding Math 2320 (Calculus II) in the requirements of the Methatronics Engineering Technology program. This addition is very reasonable for this program.

Math department is also fine with the removal of Math 1280 for the requirements in the Methatronics Engineering Technology program. But Math department also understands that Math 1280 is an important prerequisite for Math 1310 (or 1340 and 1350), and this prerequisite is not changed. Your students can pass any type of placement test or Math 1280 to take Calculus courses (Math 1310-2320).

In summary, Math department supports this request for adding Math 2320 and removing Math 1280 in the Methatronics Engineering Technology program.

In addition, please let me know how many of your students will take Math 2320 and when this starts so that we can create sections of Math 2320 for your students.

Thanks,
Junfeng

Junfeng Shang
Professor and Chair
458 MSC | 419-372-7453
jshang@bgsu.edu



From: Mohammad A Mayyas <mmayyas@bgsu.edu>
Sent: Friday, March 4, 2022 11:13 AM
To: Junfeng Shang <jshang@bgsu.edu>
Cc: Mohammed Ibrahim Kmal Abouheaf <mabouhe@bgsu.edu>; Resmi Krishnankuttyrema <resmik@bgsu.edu>; MD Baniamin Sarder <msarder@bgsu.edu>; Linda Leimgruber <lleimgr@bgsu.edu>; Jennie Gallimore <jgallim@bgsu.edu>

Subject: Re: Request to Add/remove Math courses

Dr. Shang,

Just to clarify, math is not in favor of removing math 1280, but ok with adding the rest of classes mentioned below. Is that correct. This will simplify the discussion.

Thanks

Mohammad

Sent from my iPhone

On Mar 4, 2022, at 10:15 AM, Mohammad A Mayyas <mmayyas@bgsu.edu> wrote:

Dr. Shang,

I am copying Dr. Sarder, chair of department, and Prof. Gallimore, Dean of the college, to discuss and explain why this proposal is critical for our school of engineering proposal. All of our program faculty agreed that they don't need math 1280.

Best regards

Mohammad

Sent from my iPhone

On Mar 4, 2022, at 10:06 AM, Junfeng Shang <jshang@bgsu.edu> wrote:

Hi Mohammad,

I talked with some faculty members. They all don't think it's a good idea to remove Math 1280. Math 1310 has Math 1280 as prerequisite. Removal of Math 1280 will not allow your students to take Math 1310. Our faculty said they didn't know how to teach if students don't have the foundation of calculus courses.

I understand your points, but I'm sorry that I cannot support this change (removal of Math 1280).

Thanks,

Junfeng

Junfeng Shang
Professor and Chair
458 MSC | 419-372-7453

jshang@bgsu.edu



From: Mohammad A Mayyas <mmayyas@bgsu.edu>
Sent: Thursday, March 3, 2022 9:42 AM
To: Junfeng Shang <jshang@bgsu.edu>
Cc: Mohammed Ibrahim Kmal Abouheaf <mabouhe@bgsu.edu>; Resmi Krishnankuttyrema <resmik@bgsu.edu>; MD Baniamin Sarder <msarder@bgsu.edu>; Linda Leimgruber <lleimgr@bgsu.edu>
Subject: Re: Request to Add/remove Math courses

Dr Shang,
Our engineering technology programs will be soon converted into engineering programs under engineering school. we expect to recruit higher quality of students who fulfill the Math1310 prerequisite. Furthermore, we followed examples from engineering schools and decided that we need to focus on higher level mathematics. The proposal as it stand right now has 17 credit hours from math. We need room to address other program requirements.

we have some ideas on how our engineering students can improve our students success rate in math courses. And perhaps you and our department chair can arrange for a meeting with bigger audience in near future.

Hope this answer your concern.

Best regards
Mohammad

On Mar 3, 2022, at 9:13 AM, Junfeng Shang
<jshang@bgsu.edu> wrote:

Hi Mohammad,

Thank you for your email messages.

If Math 1280 is removed, I am afraid engineering students are not able to take Math 1310 and other calculus courses because Math 1280 is an important prerequisite for the calculus sequence courses. Though students take Math 1280

before Math 1310, the passing rate of Math 1310 is very low. If Math 1280 is removed, I am not sure how students can pass Math 1310 and other calculus courses.

Can you provide your views why you want to remove Math 1280?

Thanks,
Junfeng

Junfeng Shang
Professor and Chair
458 MSC | 419-372-7453
jshang@bgsu.edu



From: Mohammad A Mayyas <mmayyas@bgsu.edu>

Sent: Wednesday, March 2, 2022 5:20 PM

To: Junfeng Shang <jshang@bgsu.edu>

Cc: Mohammed Ibrahim Kmal Abouheaf <mabouhe@bgsu.edu>; Resmi Krishnankuttyrema <resmik@bgsu.edu>; MD Baniamin Sarder <msarder@bgsu.edu>; Linda Leimgruber <lleimgr@bgsu.edu>

Subject: Re: Request to Add/remove Math courses

Dr. Shang

I failed to mention that we would like to have your decision before March 15. We have a deadline to submit the support letters to the undergraduate college council by that time.

Also, I would like to point out that we added Math 2910, which was developed to serve our engineering population.

Thanks you for understanding and for supporting our proposal in advance.

Linda,
Could you please follow up with the Math department if needed.

Best regards

Mohammad

On Feb 28, 2022, at 3:14 PM, Mohammad A Mayyas <mmayyas@bgsu.edu> wrote:

Dr. Shang, the Chair of the Department of Mathematics and Statistics

The Mechatronics Engineering Technology is undergoing changes to its curriculum requirements. We would like to remove (MATH 1280) from the requirement, and add (MATH 2320 Calculus and analytical geometry II). With this modification, the math courses will show in our check-sheet as part of the degree requirement:

MATH 1310**Calculus and Analytic Geometry **OR**

MATH 1340**Calculus and Analytic Geometry IA &

MATH 1350 Calculus and Analytic Geometry IB

MATH 2320 Calculus and Analytical Geometry II

MATH 2470 Fundamental of Statistics

MATH 2910 Applied Engineering Mathematics with Applications

We seek your acknowledgment and support for this change, which is planned to take an effect after Fall 2023.
Best Regards

Mohammad Mayyas, Ph.D

Professor
Mechatronics Engineering Technology, Founder and Program
Director
Robotics Facility, PI
Bowling Green State University
www.bgsu.edu/robotics
mmayyas@bgsu.edu

Request to Add/Remove Phys

From: [Andrew Layden](#)
To: [Mohammed Ibrahim Kmal Abouheaf](#)
Cc: [Mohammad A Mayyas](#); [Resmi Krishnankuttyrema](#); [MD Baniamin Sarder](#)
Subject: Re: Request to add/remove Phys. courses
Date: Tuesday, March 15, 2022 12:29:20 PM

Hello all,

We have had some lively discussion in our department about increasing the enrollments in our PHYS 2110 and 2120 University Physics courses to support the proposed check sheet changes.

We can support the change to Mechatronics Engineering Technology, proposed for Fall 2023. This may require additional resources to support new TAs and/or adjuncts to cover the lab and recitation sections.

Supporting changes to the other programs we discussed will be challenging, but we will consider those issues when specific proposals are made for those programs.

Best wishes for a successful program upgrade,
-Andy Layden

Chair, Dept. of Physics & Astronomy
104C Overman Hall
Bowling Green State University
419-372-8653 || [Webpage](#)
[he/him/his]

From: Mohammed Ibrahim Kmal Abouheaf <mabouhe@bgsu.edu>
Sent: Tuesday, March 15, 2022 8:32 AM
To: Andrew Layden <laydena@bgsu.edu>
Cc: Mohammad A Mayyas <mmayyas@bgsu.edu>; Resmi Krishnankuttyrema <resmik@bgsu.edu>; MD Baniamin Sarder <msarder@bgsu.edu>
Subject: Re: Request to add/remove Phys. courses

Dear Andrew,

I appreciate if you can give us any updates about the support request,

Best Regards,

Mohammed Abouheaf, PhD

Associate Professor,
Mechatronics Engineering Technology

From: Mohammad A Mayyas <mmayyas@bgsu.edu>

Sent: March 4, 2022 10:54 AM

To: Andrew Layden <laydena@bgsu.edu>

Cc: Mohammed Ibrahim Kmal Abouheaf <mabouhe@bgsu.edu>; Resmi Krishnankuttyrema <resmik@bgsu.edu>; MD Baniamin Sarder <msarder@bgsu.edu>

Subject: Re: Request to add/remove Phys. courses

Great, thank you for working with us.
Best regards

Sent from my iPhone

On Mar 4, 2022, at 10:34 AM, Andrew Layden <laydena@bgsu.edu> wrote:

Thanks. I have shared this information with the two profs who currently teach PHYS 2110 and 2120, and our undergraduate curriculum committee. I have asked for a quick discussion, but I expect everyone will be in favor of expanding engineering at BGSU. I will have no problem responding well before your Mar 15 deadline.

Best,
Andy

Chair, Dept. of Physics & Astronomy
104C Overman Hall
Bowling Green State University
419-372-8653 || [Webpage](#)
[he/him/his]

From: Mohammad A Mayyas <mmayyas@bgsu.edu>

Sent: Friday, March 4, 2022 10:07 AM

To: Andrew Layden <laydena@bgsu.edu>; Mohammed Ibrahim Kmal Abouheaf <mabouhe@bgsu.edu>; Resmi Krishnankuttyrema <resmik@bgsu.edu>; MD Baniamin Sarder <msarder@bgsu.edu>

Subject: Re: Request to add/remove Phys. courses

Andrew,

If all technology programs transition to engineering, which is planned by fall 2023, and when we start accepting engineering Students, then there will be an impact. Most likely, you will hear similar request sometime this semester from other programs.

Definitely the transition to engineering is contingent to a process that require approval by state. We will keep your program posted when such transition takes place as this proposal is part of college strategic plan.

Please let me know if we answered your question, and if you are ok. Please let us know so we can add that in the proposal.

Thanks

Mohammad

On Mar 4, 2022, at 9:30 AM, Andrew Layden <laydena@bgsu.edu> wrote:

Thanks, Mohammad. That will require a big change in the way we handle the PHYS 2110/20 courses.

Do you have a sense of whether there will be a corresponding drop in your College's majors who require the P2010/20 (algebra-based) physics?

That is, will it be a matter of shifting resource or acquiring new ones?

Thanks,
Andy

Chair, Dept. of Physics & Astronomy
104C Overman Hall
Bowling Green State University
419-372-8653 || [Webpage](#)
[he/him/his]

From: Mohammad A Mayyas <mmayyas@bgsu.edu>

Sent: Thursday, March 3, 2022 5:22 PM

To: Andrew Layden <laydena@bgsu.edu>

Cc: Mohammed Ibrahim Kmal Abouheaf <mabouhe@bgsu.edu>; Resmi Krishnankuttyrema <resmik@bgsu.edu>; MD Baniamin Sarder <msarder@bgsu.edu>; Linda Leimgruber <lleimgr@bgsu.edu>

Subject: RE: Request to add/remove Phys. courses

Andy

We expected to have 150 students added annually to all programs.
Thank you very much for sharing the excitement. We look forward to your support. An "OK" reply to this email will be sufficient .
Mohammad

From: Andrew Layden

Sent: Thursday, March 3, 2022 4:47 PM

To: Mohammad A Mayyas <mmayyas@bgsu.edu>

Cc: Mohammed Ibrahim Kmal Abouheaf <mabouhe@bgsu.edu>; Resmi Krishnankuttyrema <resmik@bgsu.edu>; MD Baniamin Sarder <msarder@bgsu.edu>; Linda Leimgruber <lleimgr@bgsu.edu>

Subject: Re: Request to add/remove Phys. courses

Hi Mohammad,

Thanks for the additional information. I'm excited to hear about your College's move to develop engineering programs!

When you say 150 students, that's across all 4 years, so $150/4 \sim 40$ in the PHYS 21x0 courses in any year... correct? That about doubles the class size, but we should be able to manage it if we add lab sections.

I would be very happy to hear as your engineering programs develop and fill in. Please stay in touch. Very exciting for you all and for BGSU.

Cheers,
Andy

Chair, Dept. of Physics & Astronomy
104C Overman Hall
Bowling Green State University
419-372-8653 || [Webpage](#)
[he/him/his]

From: Mohammad A Mayyas <mmayyas@bgsu.edu>

Sent: Thursday, March 3, 2022 2:58 PM

To: Andrew Layden <laydena@bgsu.edu>

Cc: Mohammed Ibrahim Kmal Abouheaf <mabouhe@bgsu.edu>; Resmi Krishnankuttyrema <resmik@bgsu.edu>; MD Baniamin Sarder <msarder@bgsu.edu>; Linda Leimgruber <lleimgr@bgsu.edu>

Subject: RE: Request to add/remove Phys. courses

Andy,

We understand that the phys 2110 and 2120 are offered once a year. The Mechatronics Engineering Technology is in processes to convert into robotics engineering program. The upper division physics are needed for engineering degree.

To answer the second part(s) of your question, Phys 2110 and 2120 courses will be demanded by other two programs which are also undergoing conversion into engineering. Therefore, the demand for (phys 2110 and 2120) will be based on overall engineering enrollment (system engineering, robotics engineering, electrical engineering, and mechanical/manufacturing engineering). I see opportunity in near future to open more sections/ or offer these courses multiple times. The expected number based on today's average enrollment is conservatively about 150 per year.

We thank you for your support in advance.

Best Regards
Mohammad

From: Andrew Layden
Sent: Thursday, March 3, 2022 1:22 PM
To: Mohammad A Mayyas <mmayyas@bgsu.edu>
Cc: Mohammed Ibrahim Kmal Abouheaf <mabouhe@bgsu.edu>; Resmi Krishnankuttyrema <resmik@bgsu.edu>; MD Baniamin Sarder <msarder@bgsu.edu>; Linda Leimgruber <lleimgr@bgsu.edu>
Subject: Re: Request to add/remove Phys. courses

Hi all,

The "upgrade" from our algebra-based PHYS 2010/2020 College Physics I/II sequence to the calculus-based PHYS 2110/2120 University Physics I/II sequence seems fine to me. The students will find it more challenging, but the smaller class sizes (typically 30 compared to >100) and integrated recitation will surely mean they will have better contact with the content.

I should note that we teach PHYS 2110 only in fall semester, and PHYS 2120 only in spring (concurrently with MATH 1310 Calc I and 2320 Calc II, respectively). This may significantly reduce the scheduling flexibility for your majors, and thereby impact their time to completion.

My other point of concern is the number of students this might involve each year. Could you estimate the number of majors expected, and projected growth rate?

After I get your response, I will pass this by our Curriculum Committee to get their opinion. Obviously, spring break complicates this, but I think there will be time to gather opinions before March 15.

Thanks,
Andy

Chair, Dept. of Physics & Astronomy
104C Overman Hall
Bowling Green State University
419-372-8653 || [Webpage](#)
[he/him/his]

From: Mohammad A Mayyas <mmayyas@bgsu.edu>
Sent: Wednesday, March 2, 2022 5:28 PM
To: Andrew Layden <laydena@bgsu.edu>
Cc: Mohammed Ibrahim Kmal Abouheaf <mabouhe@bgsu.edu>; Resmi Krishnankuttyrema <resmik@bgsu.edu>; MD Baniamin Sarder <msarder@bgsu.edu>; Linda Leimgruber <lleimgr@bgsu.edu>
Subject: Re: Request to add/remove Phys. courses

Dr. Layden

I failed to mention that we would like to have your decision before March 15. We have a deadline to submit the support letters to the undergraduate college council by that time.

Also, I would like to make a minor correction to the request:

(...remove (Phys2010 and Phys2020) from its current check-sheet, and “keep” (Phys2110 and Phys2120) to its check-sheet as a degree requirement....)

We replaced “add” with “keep” because phys 2110 and 2120 appeared in our current check-sheet in “or statement” , which were alternative to physics 2010 and 2020.

Thanks you for understanding and for supporting our proposal in advance.

Linda,
Could you please follow up with the physics department if needed.

Best regards
Mohammad

On Feb 28, 2022, at 3:14 PM, Mohammad A Mayyas
<mmayyas@bgsu.edu> wrote:

Dr. Layden, the Chair of Department of physics and Astronomy

The Mechatronics Engineering Technology is undergoing changes to its curriculum requirements and would like to remove (Phys2010 and Phys2020) from its current check-sheet, and add (Phys2110 and Phys2120) to its check-sheet as a degree requirement.

We seek your acknowledgment and support for this change, which is planned to take an effect after Fall 2023.

Best Regards

Mohammad Mayyas, Ph.D
Professor
Mechatronics Engineering Technology, Founder and Program Director
Robotics Facility, PI
Bowling Green State University
www.bgsu.edu/robotics
mmayyas@bgsu.edu



An evaluation of employer demand for graduates from the proposed bachelor's-level robotics and artificial intelligence program in both the nationwide and regional markets, and student demand for similar programs.

Analysis Includes:

- Job Posting Trends
- Top Titles
- Top Skills
- Top Employers
- Top Industries
- Top Cities
- Top Experience Levels
- Top Education Levels
- Degree Completion Trends

The analysis considered demand in:

- Nationwide
- Regional

Options for Next Steps

Following this analysis, the requesting partner can:

- Choose to discontinue the research, if the leadership is able to make a decision based on this analysis and other institutional research.
- Continue the analysis. A final report of the continued research will address credential design and curricular recommendations.

Despite a Challenging Competitive Landscape, Increasing Employer and Student Demand Suggests Program Potential

Preliminary Program Outlook

Rising employer demand suggests high need for bachelor's-level robotics and artificial intelligence professionals. From June 2018 to May 2021, national relevant employer demand growth grew an average 3.42 percent per month, outpacing growth for all bachelor's-level professionals (i.e., 0.99 percent). During the same period, regional employer demand growth for relevant professions outpaced the average monthly demand for all bachelor's-level professionals (i.e., 3.44 percent compared to 1.05 percent, respectively). Additionally, national and regional employers posted a moderate number of relevant job postings between June 2020 and May 2021 (i.e., 303,679 and 23,173 job postings, respectively). These trends suggest a favorable labor market for program graduates.

Increasing relevant degree completions suggests growing student interest. Between the 2014-2015 and 2018-2019 academic years, national degree completions increased an annual average 81.85 percent, outpacing the growth in the number of institutions reporting completions (i.e., 42.50 percent). This indicates growth in student interest is faster than growth in competition, making for a favorable competitive landscape. In the same period, there was a net growth of 106 relevant regional completions (i.e., from zero completions to 106 completions), outpacing the net growth of three regional institutions reporting completions (i.e., from one institution to four institutions). This indicates potential for new programs to enter the market.

Potential regional market concentration challenges the proposed program. Worcester Polytechnic Institute captured over 78 percent of the market. Additionally, Worcester Polytechnic Institute's 83 reported completions in the 2018-2019 academic year is significantly larger than the regional 26.50 mean completions per reporting institution. This suggests that new programs may struggle to attract students. However, all four regional institutions experienced an increased in number of reported completions. This indicates new programs may capture student interest. Additionally, the University could use existing engineering and computer science courses to potentially limit program launch costs and limit growth risk.

Research Limitations

As institutions self-report data to the National Center for Education Statistics (NCES), some comparable programs may report completions for a bachelor's-level robotics and artificial intelligence program under an alternate CIP code and may not be included in the analysis. Additionally, the CIP codes used may not be specific to robotics and artificial intelligence, thus a broader view of the competitive landscape may be shown.

Covid-19 Caveat

This analysis was completed during the 2020-2021 novel coronavirus outbreak, and we cannot yet anticipate how the ensuing economic downturn and eventual recovery will deviate from historic labor market trends. Additionally, program delivery recommendations assume a long-term, non-pandemic environment and may need to be adapted to current public health guidelines (e.g., emergency remote instruction of face-to-face programs). The recommendations and insights are based on the best available information, but program decision making is occurring in an unprecedented context. Leadership may want to refresh the analysis later to understand how the labor market has responded.

National Analysis of Job Postings for Bachelor's-Level Robotics And A.I. Professionals

Nationwide employer demand trends suggest high need for program graduates. Employers posted a moderate number of relevant job postings in the last 12 months (i.e., 303,679 job postings). Further, relevant employer demand increased an average 3.42 percent monthly from June 2018 to May 2021, outpacing employer demand growth for bachelor's-level professionals overall (i.e., 0.99 percent).

While employer demand for bachelor's-level robotics and professionals declined from July 2019 to June 2020, demand steadily grew from July 2020 through May 2021. This indicates a favorable labor market for program graduates.

+3.42%

Average Monthly Demand Growth

June 2018 - May 2021, Nationwide Data

- Average monthly growth of 1,646 postings.
- During the same period, demand for all bachelor's-level professionals grew 0.99 percent.

54,498 job postings

Average Monthly Demand

June 2018 - May 2021, Nationwide Data

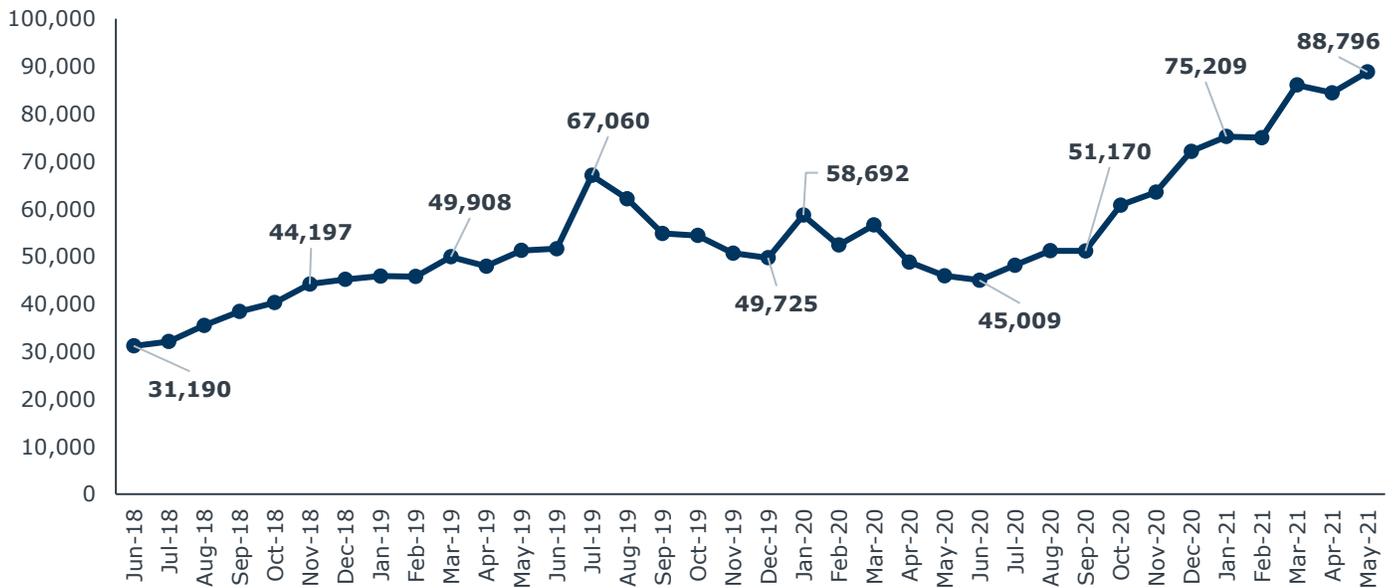
303,679 job postings

Relevant Jobs Posted in the Past Year

June 2020 - May 2021, Nationwide Data

Job Postings for Bachelor's-Level Robotics And A.I. Professionals over Time

June 2018 - May 2021, Nationwide Data



Source: EAB analysis. Emsi Analyst.

Regional Analysis of Job Postings for Bachelor's-Level Robotics And A.I. Professionals

Like nationwide trends, regional employer demand trends suggest high need for program graduates. Employers posted a moderate number of relevant job postings in the last 12 months (i.e., 23,173 job postings). Additionally, relevant employer demand outpaced employer demand for all bachelor's-level professionals from June 2018 to May 2021 (i.e., an average 3.44 percent monthly compared to 1.05 percent respectively). This indicates program graduates may enter a growing labor market.

Similar to the national trend, employer demand decreased from July 2019 to June 2020. However, demand grew from July 2020 through May 2021.

+3.44%

Average Monthly Demand Growth

June 2018 - May 2021, Regional Data

- Average monthly growth of 120 postings.
- During the same period, demand for all bachelor's-level professionals grew 1.05 percent.

4,055 job postings

Average Monthly Demand

June 2018 - May 2021, Regional Data

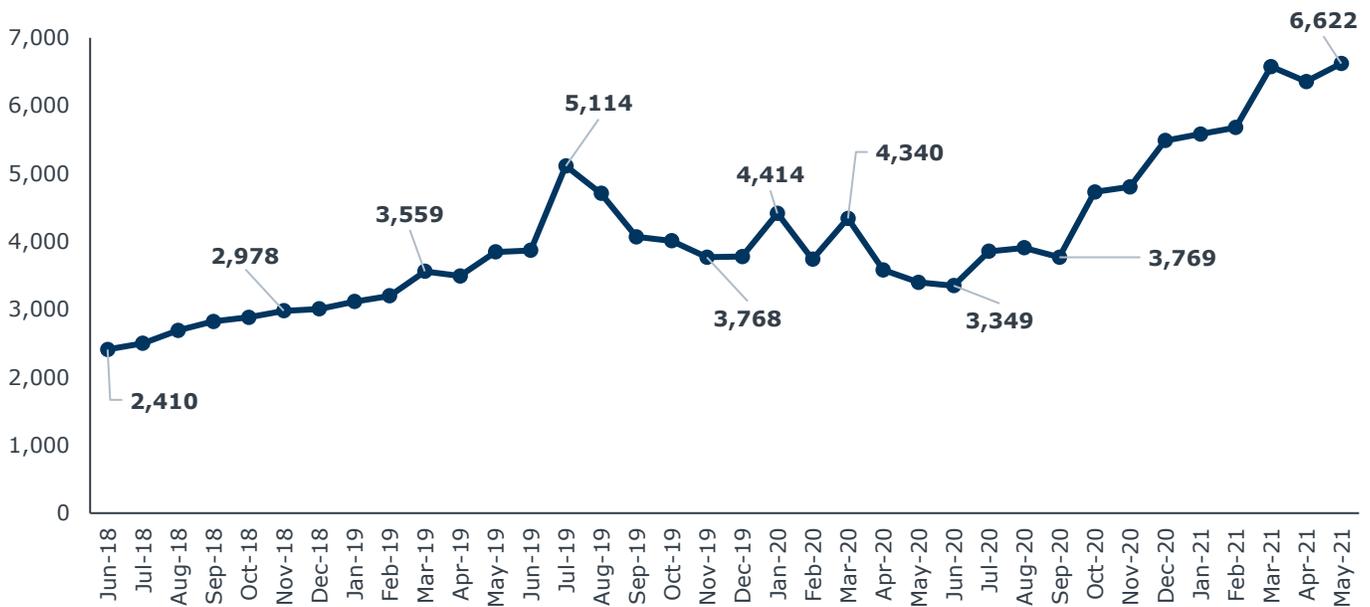
23,173 job postings

Relevant Jobs Posted in the Past Year

June 2020 - May 2021, Regional Data

Job Postings for Bachelor's-Level Robotics And A.I. Professionals over Time

June 2018 - May 2021, Regional Data



Source: EAB analysis. Emsi Analyst.

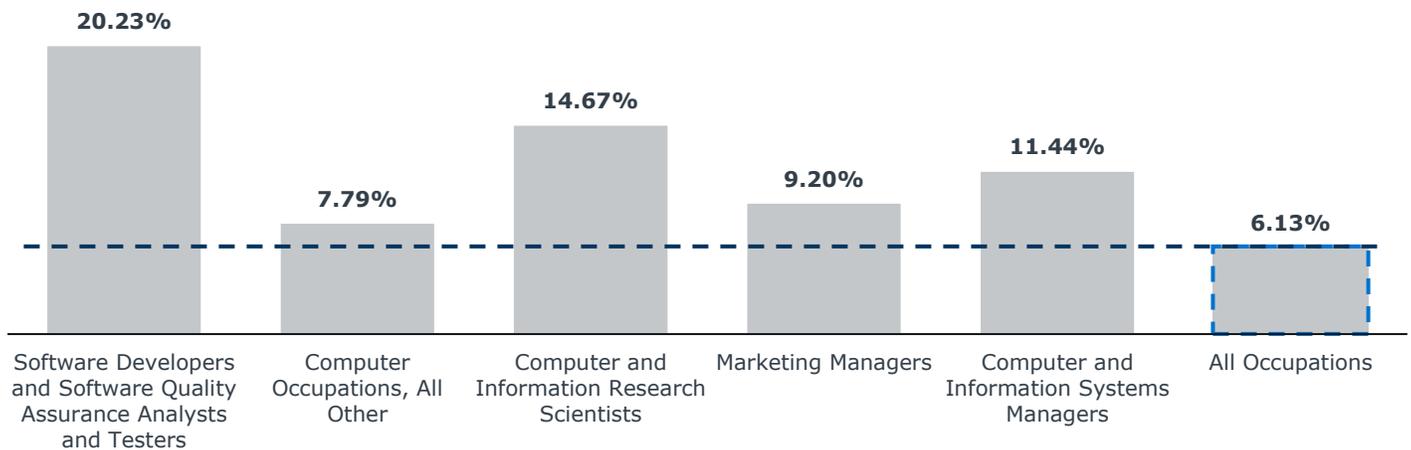
Analysis of Employment for Robotics and A.I. Professionals

Nationwide and regional employment is projected to increase faster than average in all the top five most frequently posted occupations. The relevant occupation “Software Developers and Software Quality Assurance Analysts and Testers” is projected to grow more than three times faster than average nationally and more than seven times faster than average regionally. This indicates employment opportunities for graduates will likely increase in coming years.

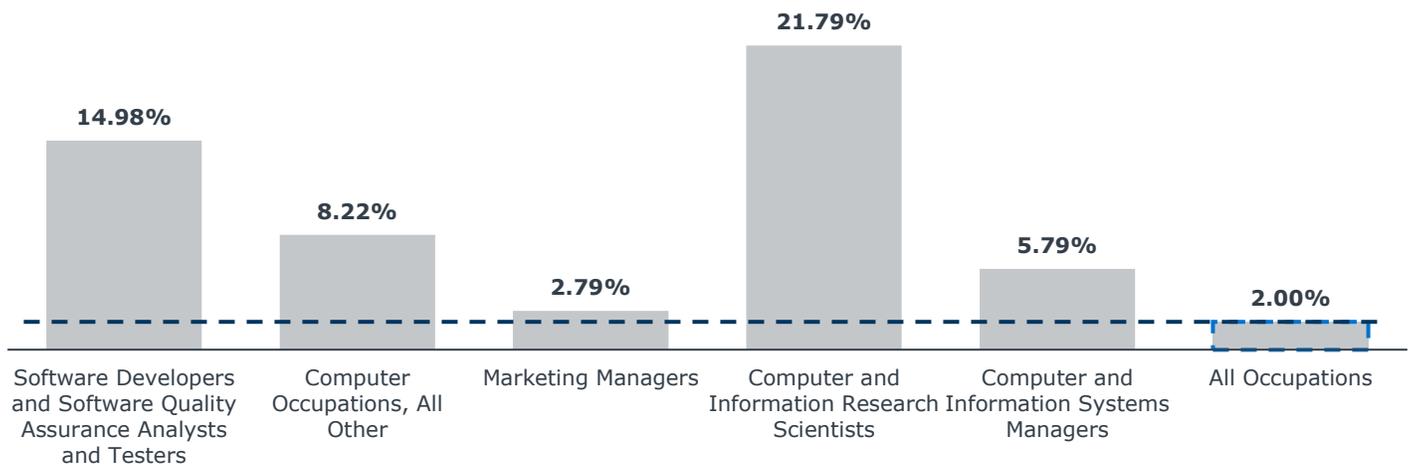
While these occupations represent the most common occupations appearing in job postings for bachelor’s-level robotics and artificial intelligence professionals, the projected employment data considers all jobs within an occupation at all degree levels.

Projected Employment in Top Occupations¹

2021-2031, Nationwide Data



2021-2031, Regional Data



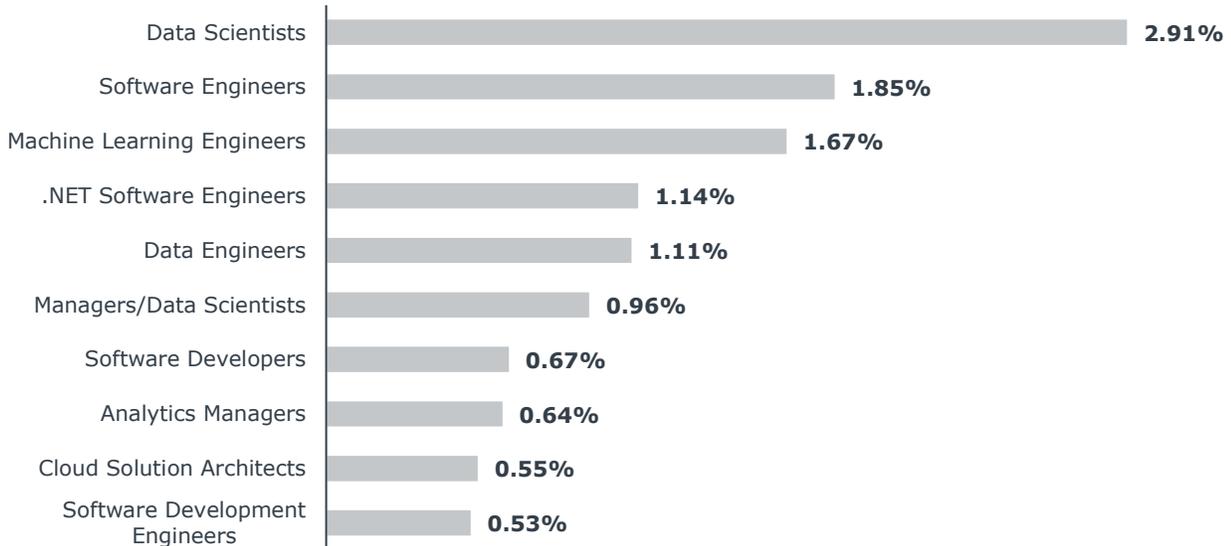
--- The dashed blue line represents the projected employment growth across all occupations from 2021 to 2031.

1) Top occupations refer to the occupations in which employers most often seek relevant professionals.

Top Titles in Job Postings for Bachelor's-Level Robotics And A.I. Professionals

June 2020 - May 2021, Nationwide Data

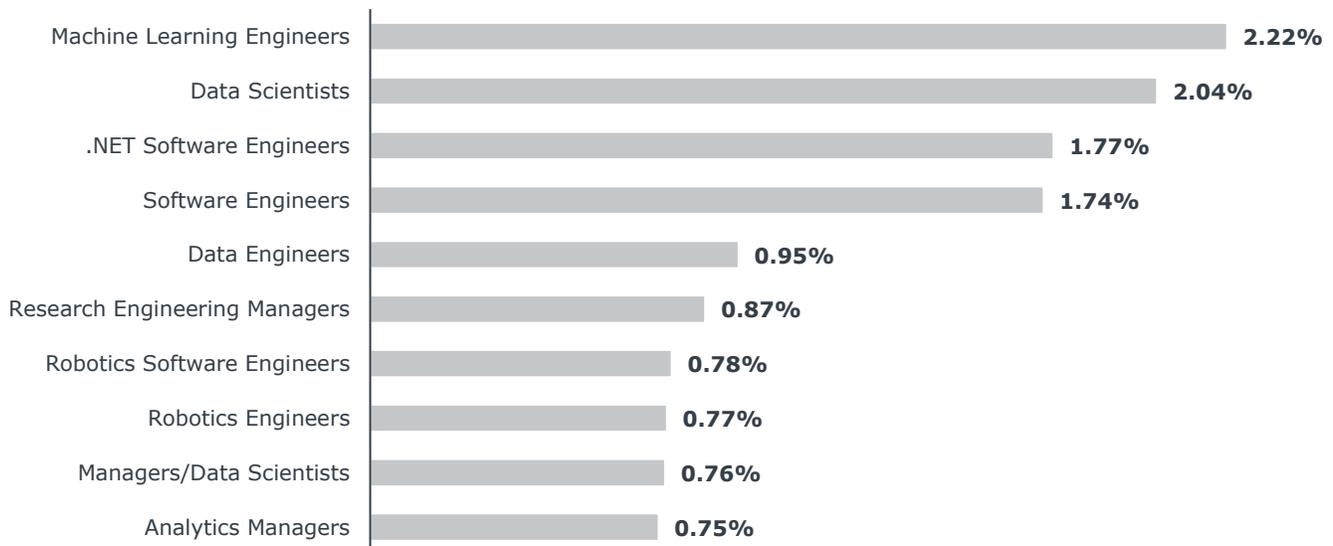
n = 303,679 job postings



Top Titles in Job Postings for Bachelor's-Level Robotics And A.I. Professionals

June 2020 - May 2021, Regional Data

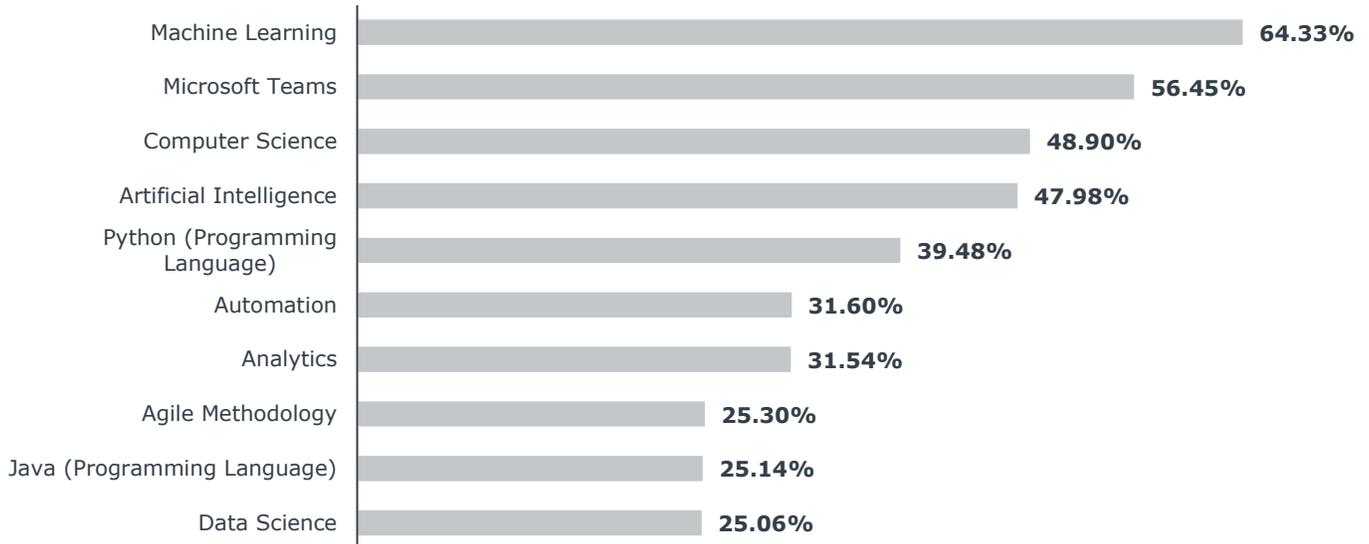
n = 23,173 job postings



Top Skills Requested of Bachelor's-Level Robotics And A.I. Applicants

June 2020 - May 2021, Nationwide Data

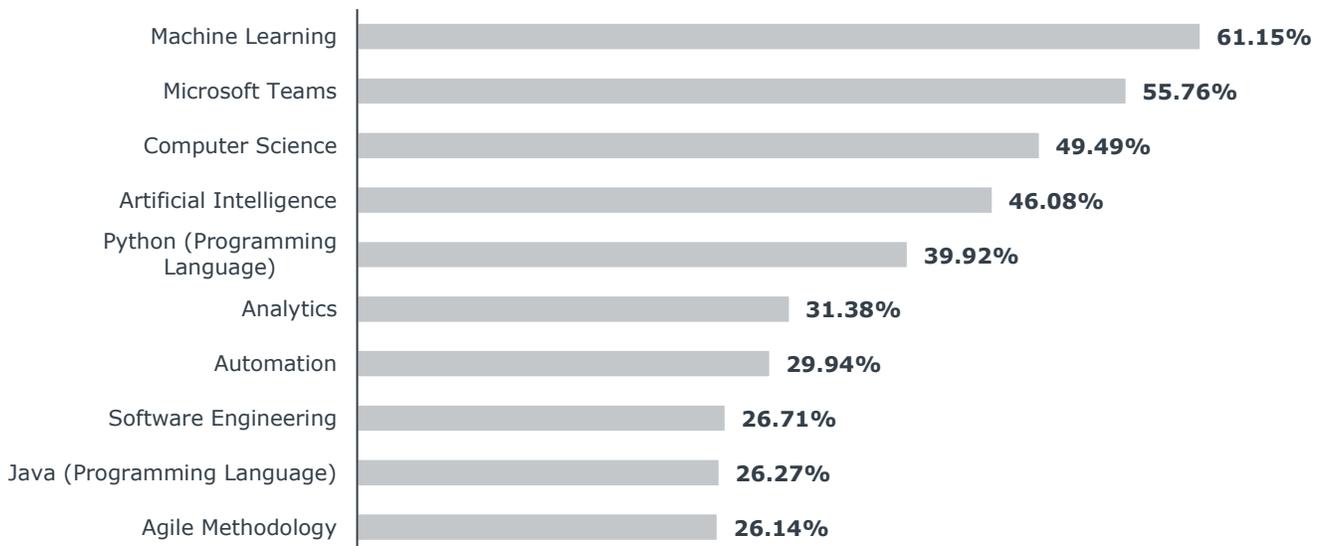
n = 303,679 job postings



Top Skills Requested of Bachelor's-Level Robotics And A.I. Applicants

June 2020 - May 2021, Regional Data

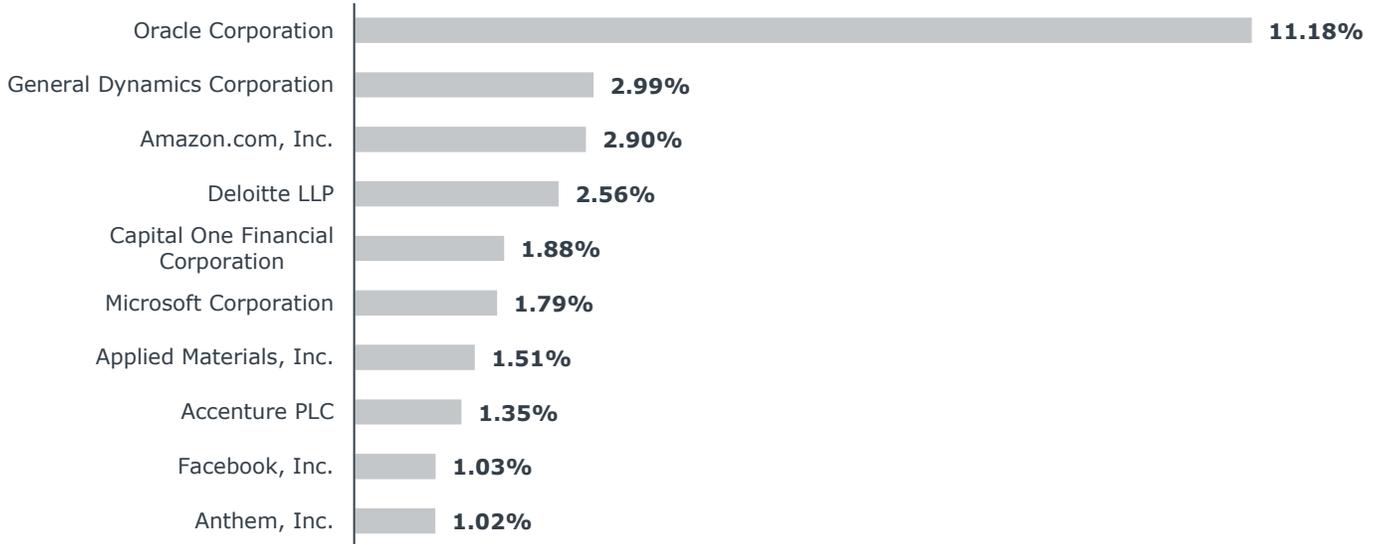
n = 23,173 job postings



Top Employers Seeking Bachelor's-Level Robotics And A.I. Applicants

June 2020 - May 2021, Nationwide Data

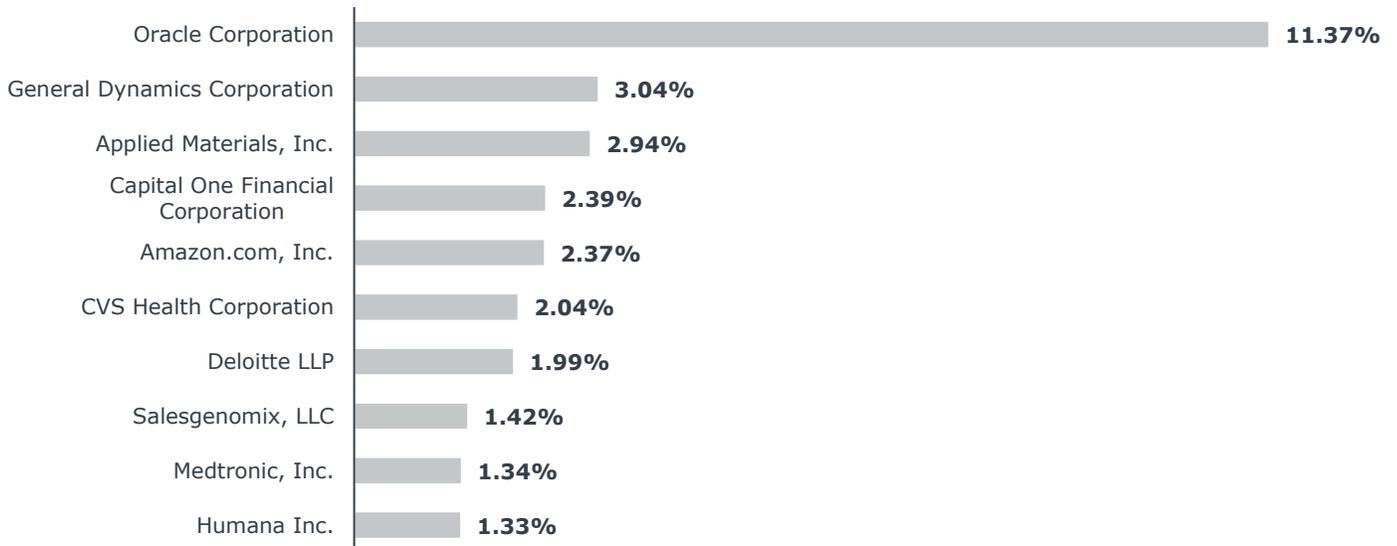
n = 303,679 job postings



Top Employers Seeking Bachelor's-Level Robotics And A.I. Applicants

June 2020 - May 2021, Regional Data

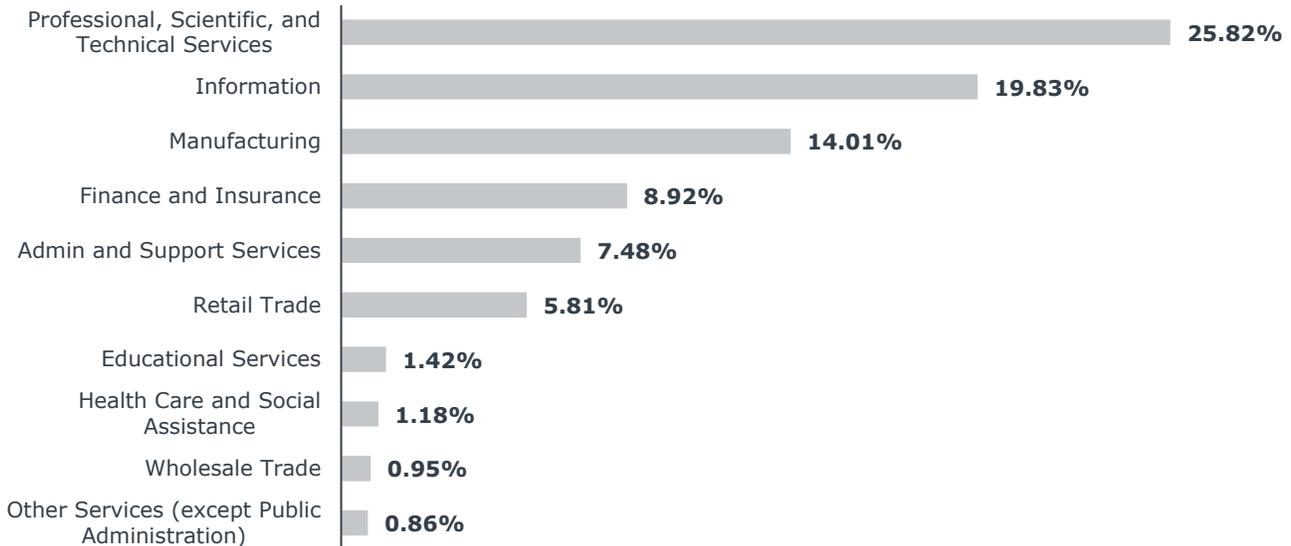
n = 23,173 job postings



Top Industries Advertising Bachelor's-Level Robotics And A.I. Job Postings

June 2020 - May 2021, Nationwide Data

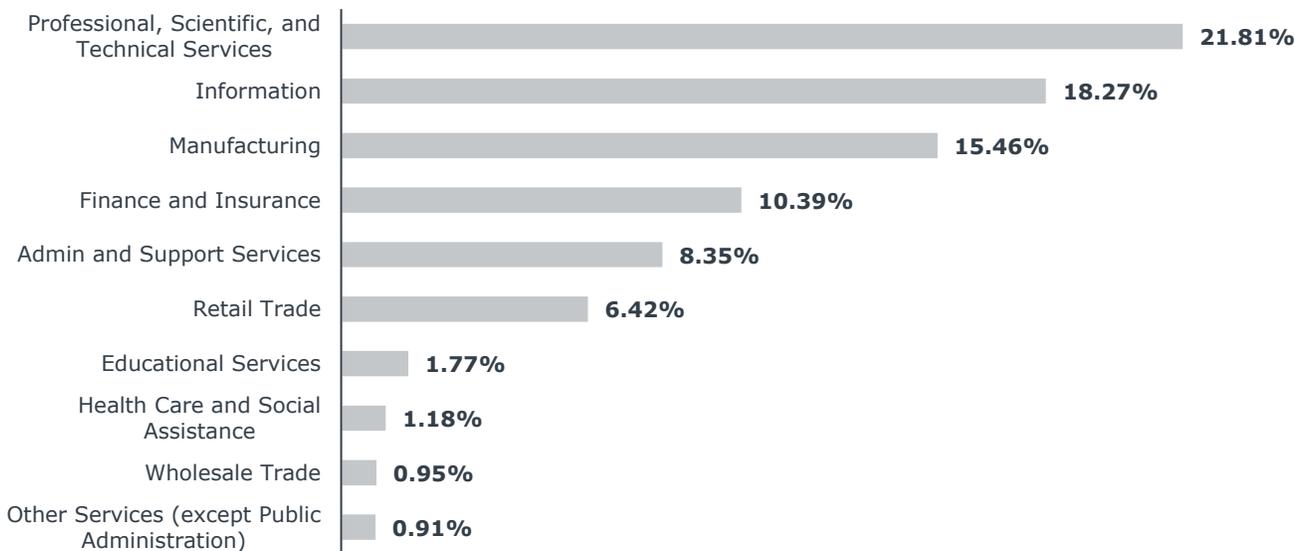
n = 303,679 job postings



Top Industries Advertising Bachelor's-Level Robotics And A.I. Job Postings

June 2020 - May 2021, Regional Data

n = 23,173 job postings

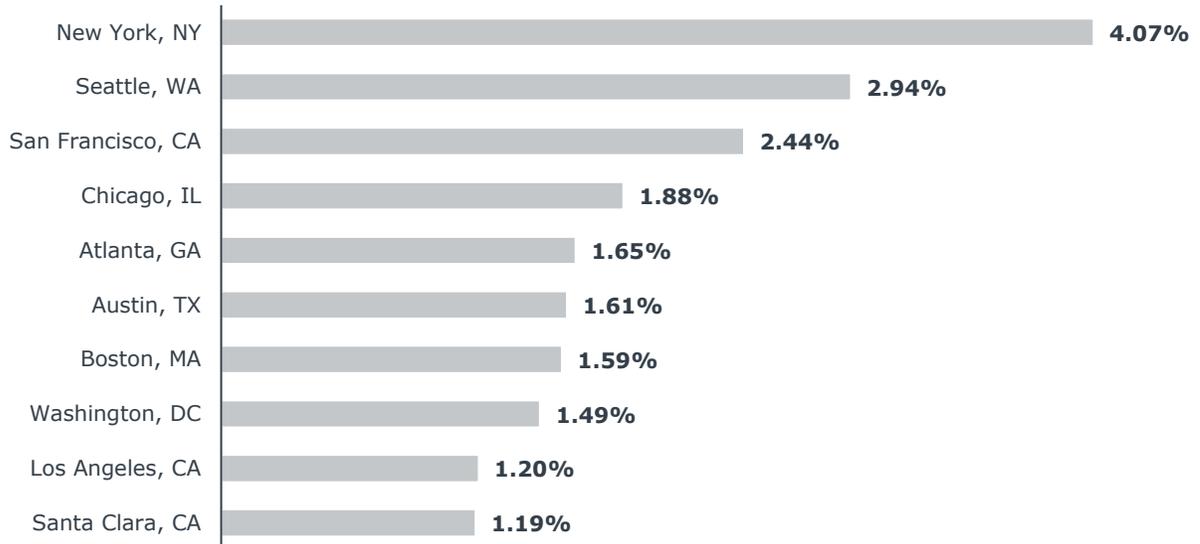


1) Label abbreviations: "Admin and Support Services" - Administrative and Support and Waste Management and Remediation Services

Top Cities Seeking Bachelor's-Level Robotics And A.I. Applicants

June 2020 - May 2021, Nationwide Data

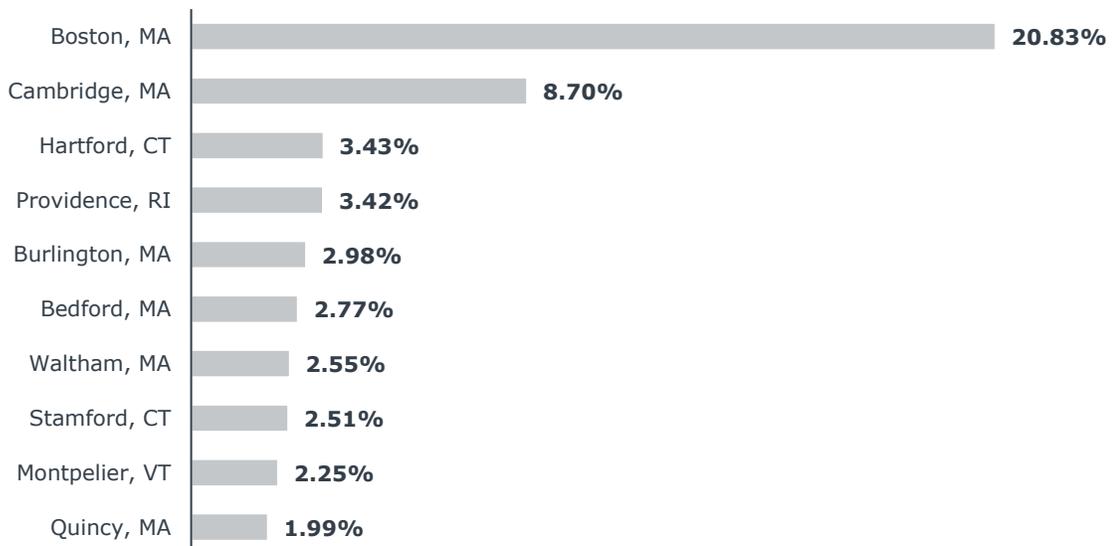
n = 303,679 job postings



Top Cities Seeking Bachelor's-Level Robotics And A.I. Applicants

June 2020 - May 2021, Regional Data

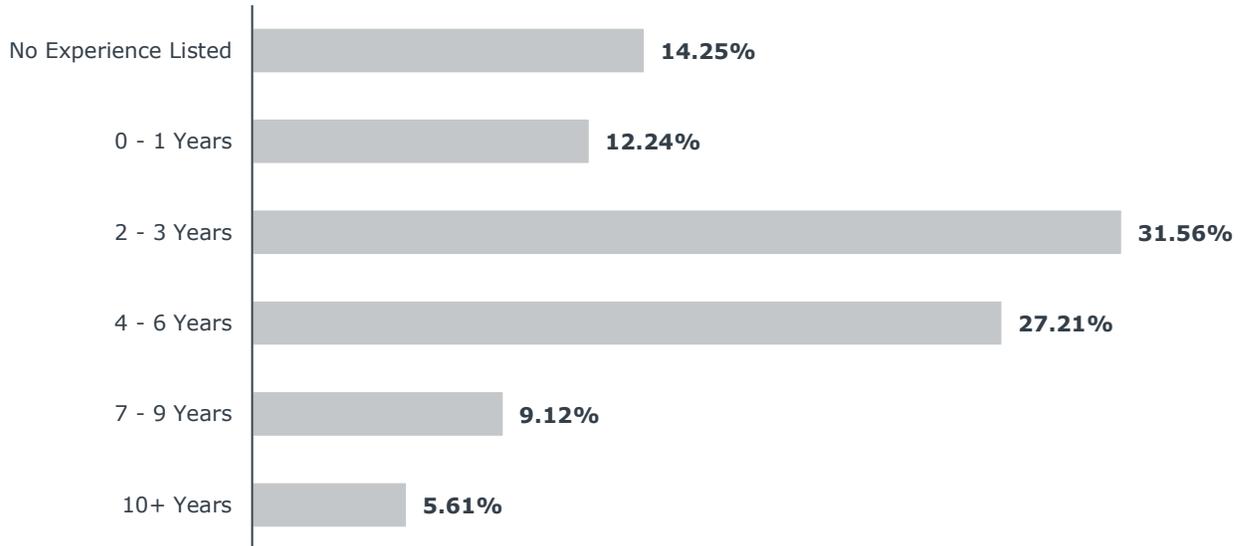
n = 23,173 job postings



Top Experience Levels Requested of Bachelor's-Level Robotics And A.I. Applicants

June 2020 - May 2021, Nationwide Data

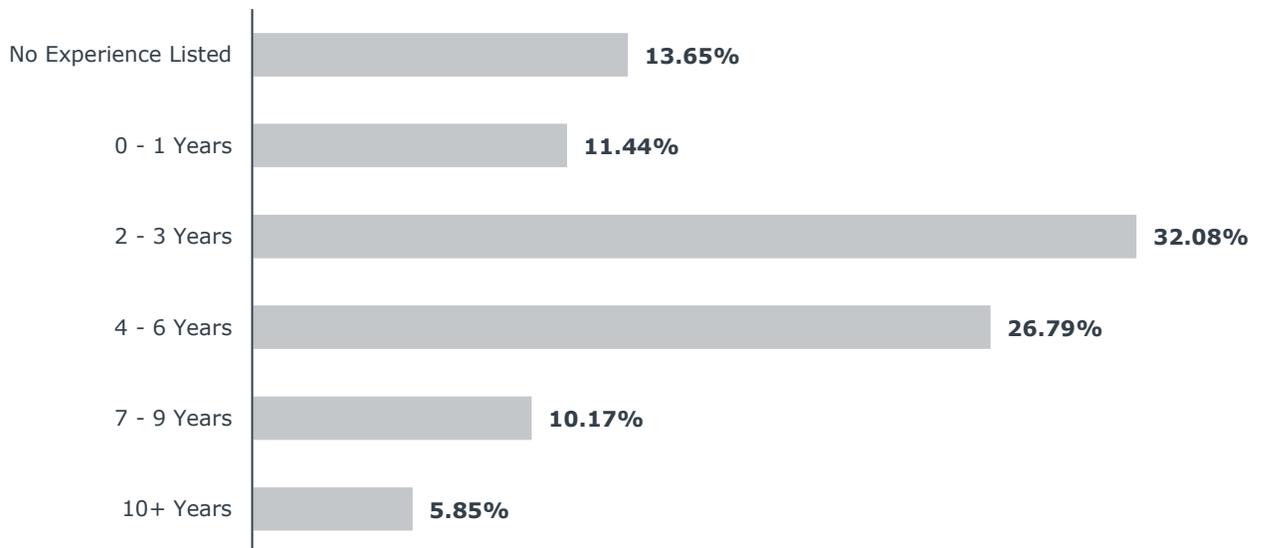
n = 303,679 job postings



Top Experience Levels Requested of Bachelor's-Level Robotics And A.I. Applicants

June 2020 - May 2021, Regional Data

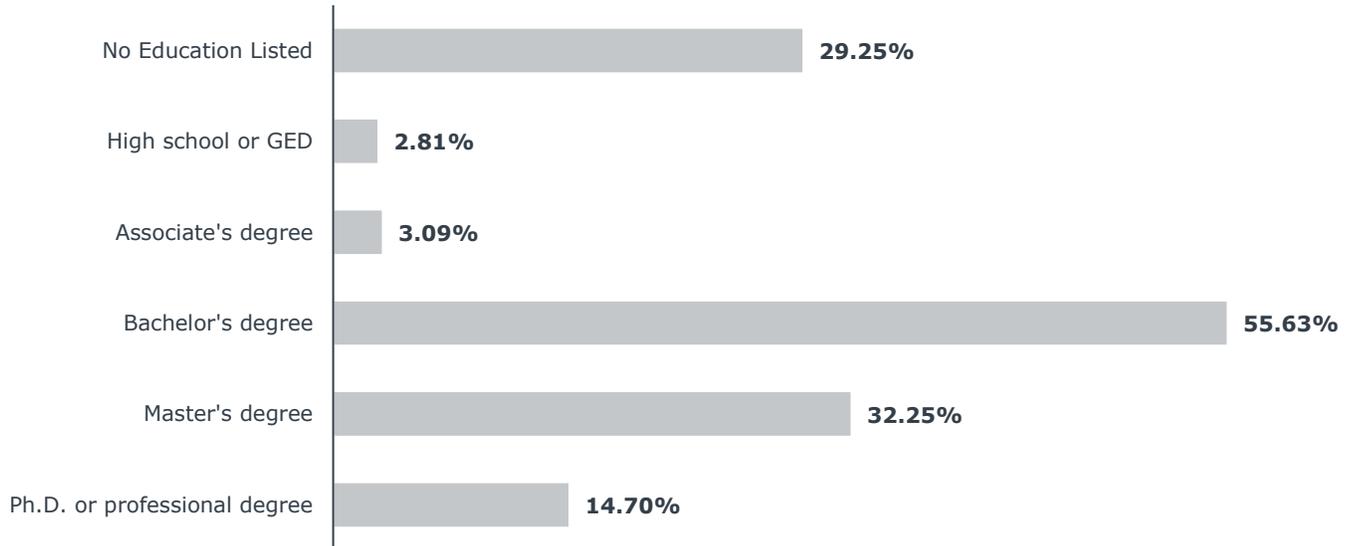
n = 23,173 job postings



Top Education Levels Requested of Robotics And A.I. Applicants

June 2020 - May 2021, Nationwide Data

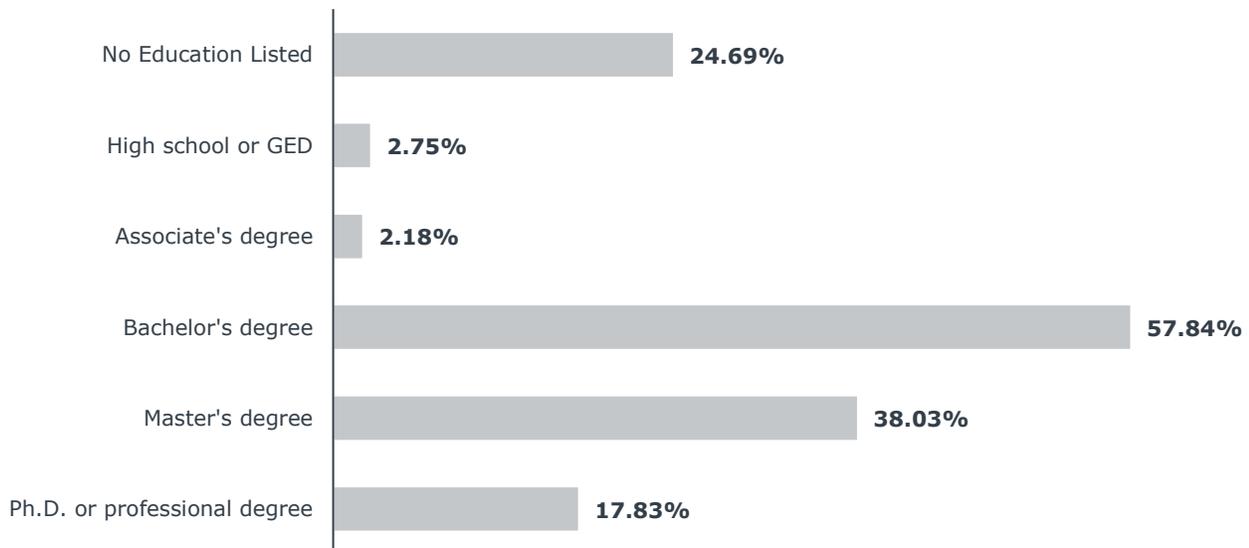
n = 524,434 job postings¹



Top Education Levels Requested of Robotics And A.I. Applicants

June 2020 - May 2021, Regional Data

n = 37,317 job postings¹



1) The n-value reflects the number of job postings requesting any degree level robotics and artificial intelligence applicants rather than the number of postings requesting bachelor's-level robotics and artificial intelligence applicants.

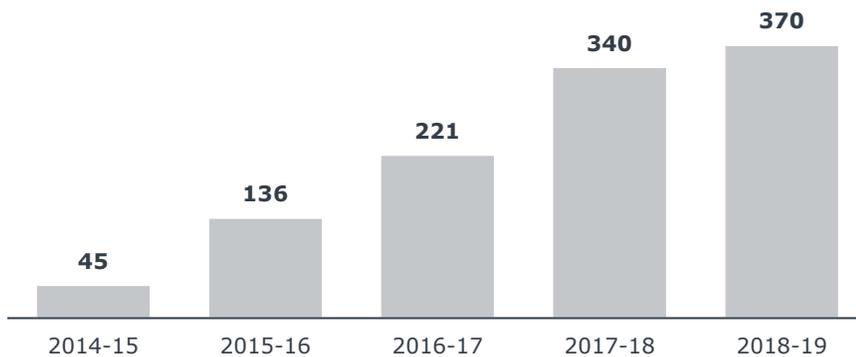
Nationwide Analysis of Relevant CIP Codes¹ Bachelor's-Level Completions

Relevant completions increased on average 81.85 percent annually between the 2014-2015 and 2018-2019 academic years. In the same period, the number of institutions reporting relevant completions grew by an average 42.50 percent annually, signaling higher growth in student demand than growth in competition. Additionally, the increase in the median and mean number of completions per reporting institution indicates a possible opportunity for programs to enter the market and capture student demand.

Completions Reported over Time

2014-2015 to 2018-2019 Academic Years, Nationwide Data

+81.85%



Average Annual Completions Growth

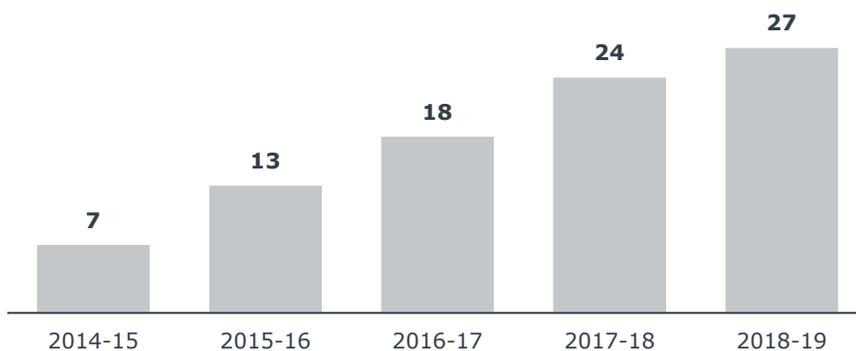
2014-2015 to 2018-2019 Academic Years, Nationwide Data

- Average annual 42.50 percent growth in number of institutions in the same period.

Institutions Reporting Completions over Time

2014-2015 to 2018-2019 Academic Years, Nationwide Data

7.41%



Institutions Reporting Completions with a 100% Distance-Delivery Option

2018-2019 Academic Year, Nationwide Data

13.70

Mean Completions per Institution Reporting

2018-2019 Academic Year, Nationwide Data

- An increase from the 6.43 mean completions reported in the 2014-2015 academic year.

5.00

Median Completions per Institution Reporting

2018-2019 Academic Year, Nationwide Data

- An increase from the 4.00 median completions reported in the 2014-2015 academic year.

1) The aggregated completions data for CIP codes '15.0405 ("Robotics Technology/Technician")', '11.0102 ("Artificial Intelligence")' and '14.4201 ("Mechatronics, Robotics, and Automation Engineering")' is offered as an indicator of student trends because Robotics And A.I. is not classified as a specific CIP code in NCES data.

Nationwide Analysis of Relevant CIP Codes¹ Bachelor's-Level Completions

Seven of the top 10 institutions reporting completions experienced an increase in market share and all top 10 institutions saw an increase the number of reported completions across the 2014-2015 and 2018-2019 academic years. Additionally, six of the top 10 institutions did not report completions in the 2014-2015 academic year, which shows the potential for new programs to capture student interest. However, eight of the 27 total national institutions reported zero completions in the 2018-2019 academic year. This indicates new programs may struggle to capture student demand. Administrators should note, the University should not expect a high volume of completions in the event of launch.

Although three CIP codes were aggregated in the analysis, the total completions listed below may capture more than one program per institution.

Institutions with Most Reported Completions

2014-2015 to 2018-2019 Academic Years, Nationwide Data

Institution	Reported Completions, 2014-2015 Academic Year	Market Share, 2014-2015 Academic Year	Reported Completions, 2018-2019 Academic Year	Market Share, 2018-2019 Academic Year
Worcester Polytechnic Institute	Not Offered	Not Offered	83	22.43%
Middle Tennessee State University	Not Offered	Not Offered	79	21.35%
United States Naval Academy	Not Offered	Not Offered	55	14.86%
University of Washington-Seattle Campus	23	51.11%	24	6.49%
Indiana State University	9	20.00%	19	5.14%
California University of Pennsylvania	Not Offered	0.00%	19	5.14%
Full Sail University	Not Offered	0.00%	18	4.86%
Carnegie Mellon University	7	15.56%	17	4.59%
Western New England University	Not Offered	Not Offered	10	2.70%
Central Connecticut State University	0	0.00%	9	2.43%



Institutions offering a distance-delivery modality in the 2018-2019 academic year.

The aggregated completions data for CIP codes '15.0405 ("Robotics Technology/Technician")', '11.0102 ("Artificial Intelligence")' and '14.4201 ("Mechatronics, Robotics, and Automation Engineering")' is offered as an indicator of student trends because Robotics And A.I. is not classified as a specific CIP code in NCES data.

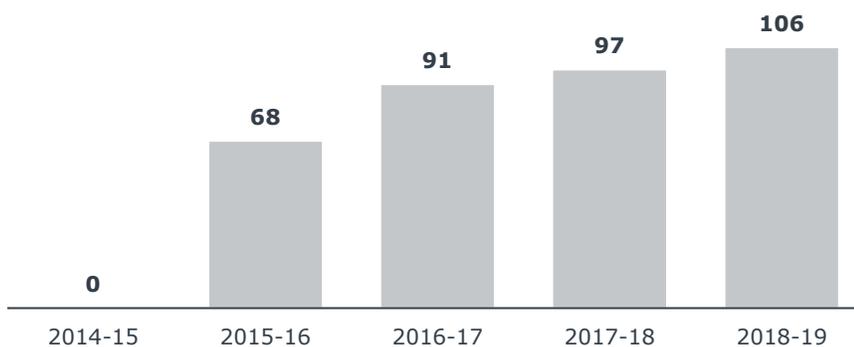
Regional Analysis of Relevant CIP Codes¹ Bachelor's-Level Completions

Relevant completions experienced a net growth of 106 completions across the 2014-2015 and the 2018-2019 academic years. In the same period, the number of institutions reporting relevant completions grew by three institutions (i.e., from one institution to four institutions). This indicates growth in student demand is greater than growth in competition. Further, the increasing mean and median number of completions suggests new programs may be able to successfully capture student demand. However, Worcester Polytechnic Institute's 83 reported completions skewed the 26.50 mean completions per reporting institution. This indicates one large competitor disproportionately represents the number of completions and new programs may struggle to capture student demand.

Completions Reported over Time

2014-2015 to 2018-2019 Academic Years, Regional Data

106



Net Growth in Completions

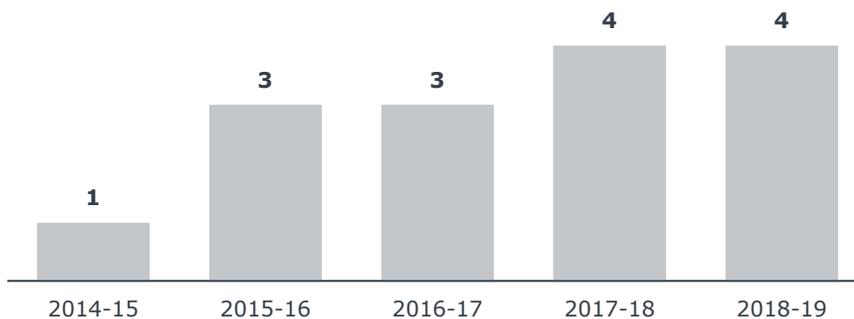
2014-2015 to 2018-2019 Academic Years, Regional Data

- Net growth of three institutions in the same period.

Institutions Reporting Completions over Time

2014-2015 to 2018-2019 Academic Years, Regional Data

0.00%



Institutions Reporting Completions with a 100% Distance-Delivery Option

2018-2019 Academic Year, Regional Data

26.50

Mean Completions per Institution Reporting

2018-2019 Academic Year, Regional Data

- An increase from the zero mean completions reported in the 2014-2015 academic year.

9.50

Median Completions per Institution Reporting

2018-2019 Academic Year, Regional Data

- An increase from the zero median completions reported in the 2014-2015 academic year.

1) The aggregated completions data for CIP codes '15.0405 ("Robotics Technology/Technician")', '11.0102 ("Artificial Intelligence")' and 14.4201 ("Mechatronics, Robotics, and Automation Engineering") is offered as an indicator of student trends because Robotics And A.I. is not classified as a specific CIP code in NCES data.

Regional Analysis of Relevant CIP Codes¹ Bachelor's-Level Completions

Between the 2014-2015 and 2018-2019 academic years, all four regional programs experienced an increase the number of reported completions and market share. This suggests new programs may be able to capture student demand. However, Worcester Polytechnic Institute disproportionately captured over 78 percent the regional market. This indicates a new program may struggle to attract students due to potential market concentration. Administrators should note no local institutions reporting relevant completions offer a distance-delivery option. This suggests an opportunity for the proposed program to differentiate itself from competitors.

Institutions with Most Reported Completions

2014-2015 to 2018-2019 Academic Years, Regional Data

Institution	Reported Completions, 2014-2015 Academic Year	Market Share, 2014-2015 Academic Year	Reported Completions, 2018-2019 Academic Year	Market Share, 2018-2019 Academic Year
Worcester Polytechnic Institute	Not Offered	0.00%	83	78.30%
Western New England University	Not Offered	0.00%	10	9.43%
Central Connecticut State University	0	0.00%	9	8.49%
Johnson & Wales University-Providence	Not Offered	0.00%	4	3.77%

The aggregated completions data for CIP codes '15.0405 ("Robotics Technology/Technician"), '11.0102 ("Artificial Intelligence") and 14.4201 ("Mechatronics, Robotics, and Automation Engineering") is offered as an indicator of student trends because Robotics And A.I. is not classified as a specific CIP code in NCES data.

Source: EAB analysis. National Center for Education Statistics.

Appendix: Research Parameters and Sources

Research Methodology

EAB's market insights research guides strategic programmatic decisions at partner institutions. The Market Insights Service combines qualitative and quantitative data to help administrators identify opportunities for new program development, assess job market trends, and align curriculum with employer and student demand.

Unless stated otherwise, this report includes data from online job postings from June 2020 to May 2021. To best estimate employer demand for bachelor's-level robotics and artificial intelligence professionals, the Forum analyzed job postings for bachelor's-level professionals with relevant skills (e.g., "Artificial Intelligence", "Robotics").

Definitions

"CIP" code refers to the Classification of Instructional Programming code.

"Regional" and "regionally" refer to New England.

"National," "Nationwide," and "nationally" refer to the United States.

Research Questions

The requesting partner asked:

- **In which industries should the proposed program prepare students to work?**
- **Which employers demonstrate the greatest demand for potential graduates?**
- **What skills should the program teach to prepare students to meet employer demand?**
- **In what positions do employers demonstrate the greatest need for graduates?**
- **In which cities do employers demonstrate the greatest demand for potential graduates?**
- **What education level do employers most frequently request from relevant professionals?**
- **What experience level do employers most frequently request from program graduates?**
- How are similar programs structured (e.g., credential awarded, cost, required credits, duration)?
- How are similar programs delivered (e.g., modality, schedule)?
- What experiential or practical learning do similar programs offer (e.g., clinical components, capstone requirements)?
- What courses are included in the curricula of similar programs?
- What accreditation do similar programs advertise?

Bolded questions were addressed within this analysis; remaining questions would be addressed if partner pursues continued research.



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