Advanced Electronic & Photonic Devices Concentration Area Review

June 1, 2022

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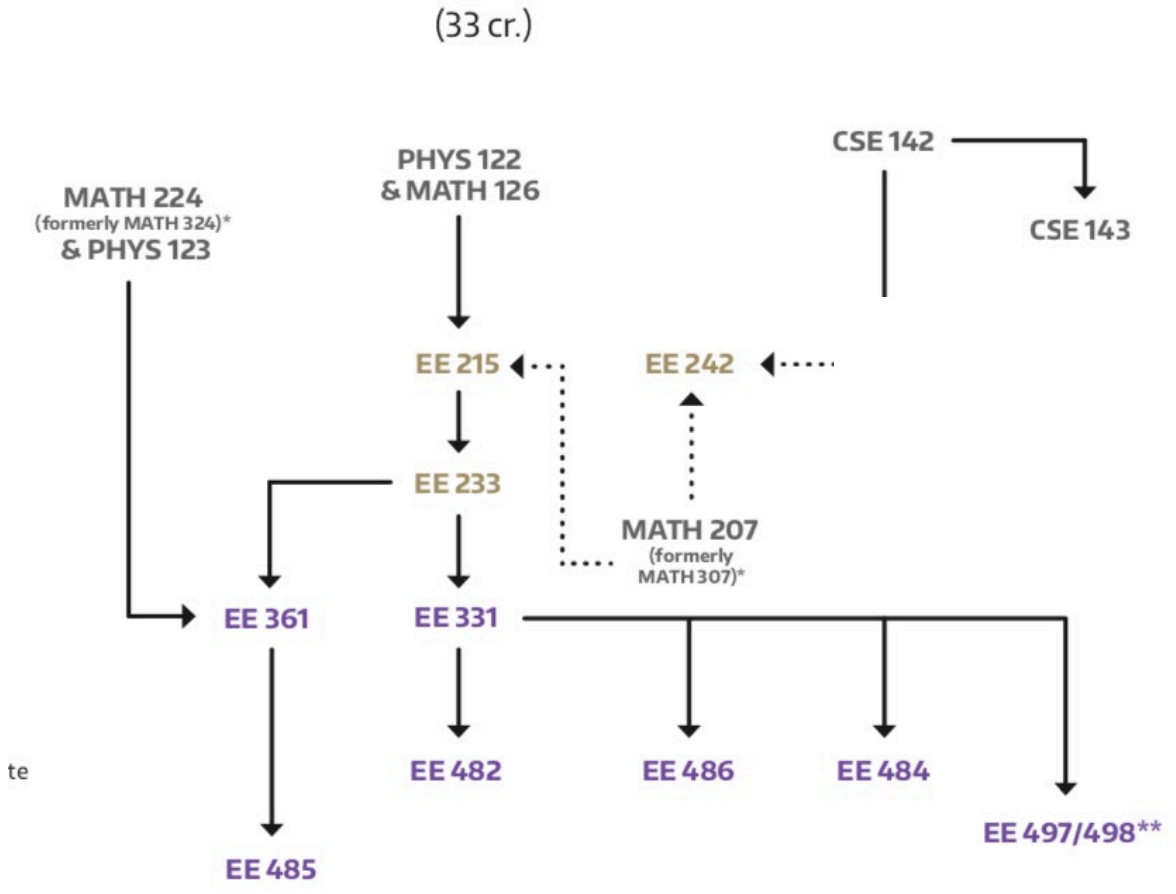
Advanced Electronic and Photonic Devices Course Flowchart



AEP supports:

- Physics majors disguised as engineering students
- Students headed to graduate school -- by providing a deep dive into fundamentals
- Students in other concentrations who want to strengthen their marketability.

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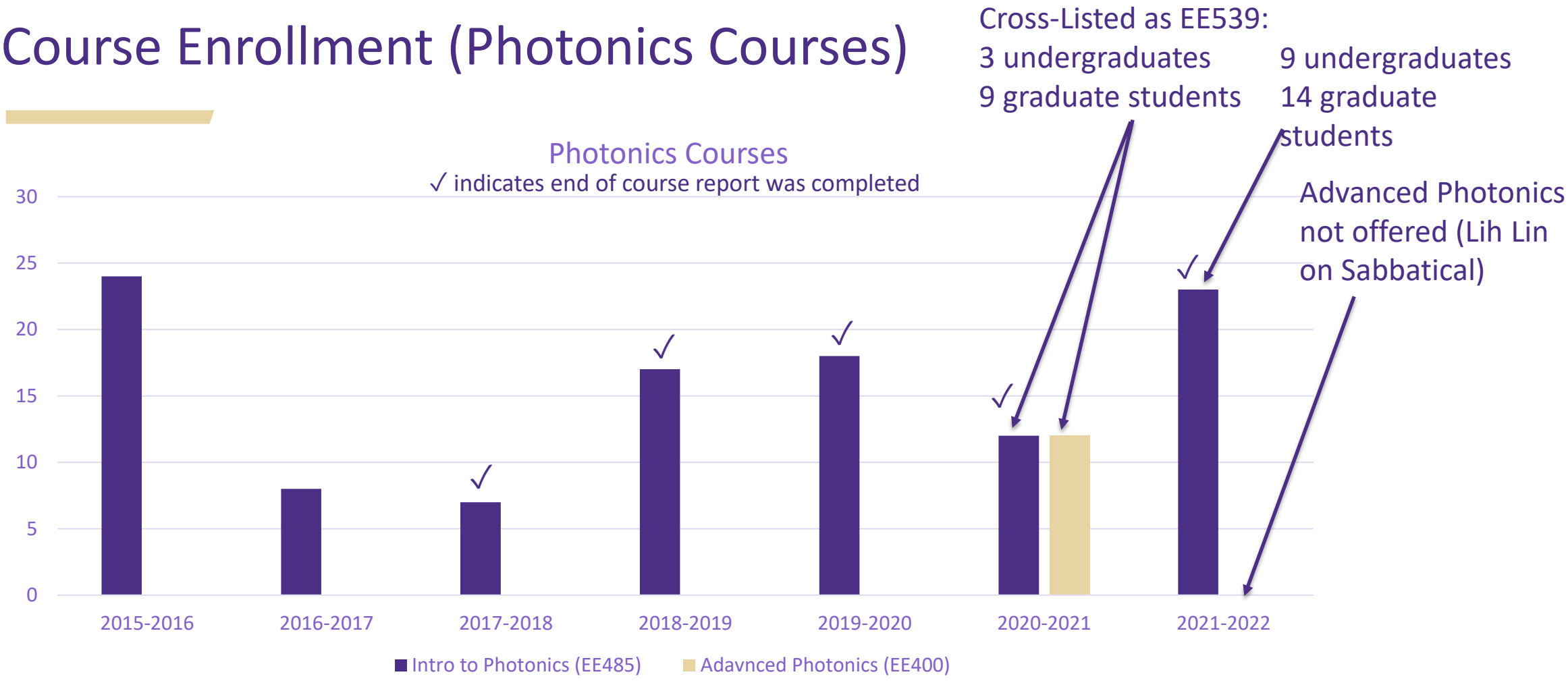
Advanced Electronic and Photonic Devices Course Enrollment (Photonics Courses)



Starting in Autumn 2022, these courses will be offered as EE487/EE587 (Introduction to Photonics, Autumn) and EE488/EE588 (Advanced Photonics, Winter)

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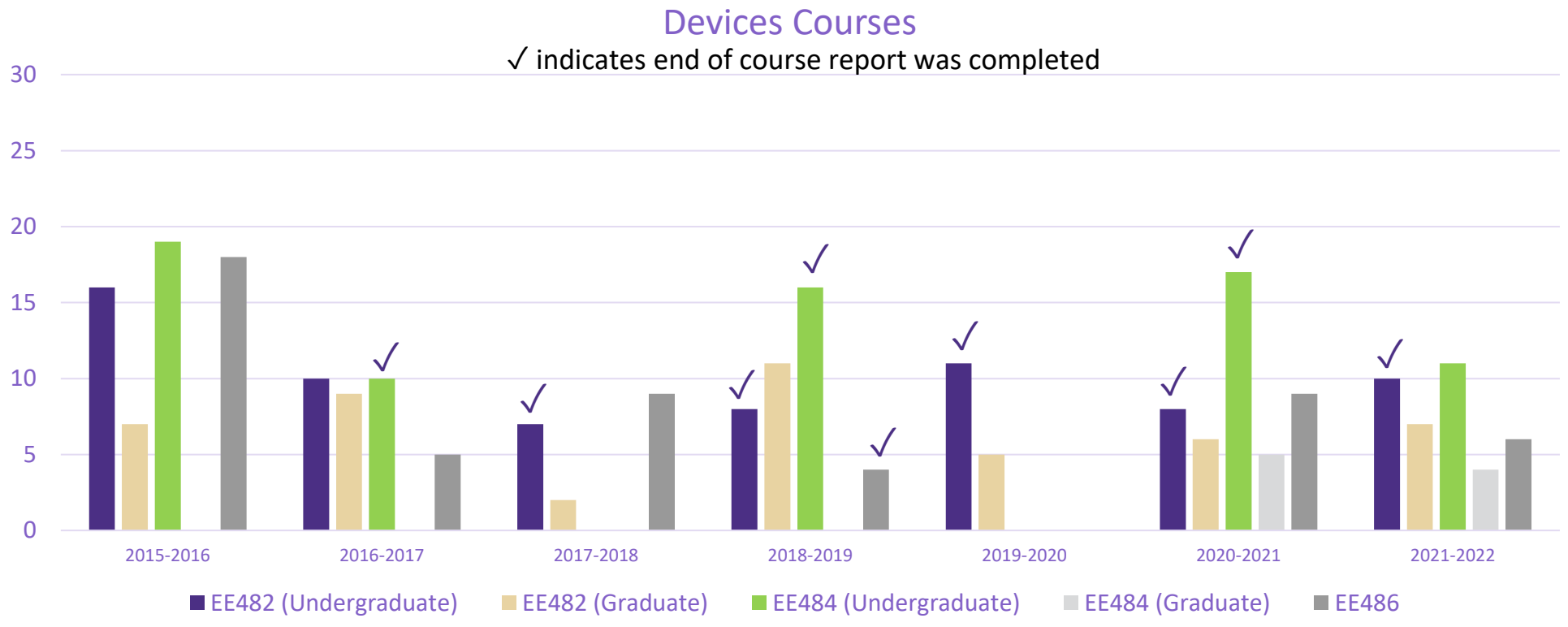
Advanced Electronic and Photonic Devices
Course Enrollment (Devices Courses)



EE482: Semiconductor Devices
EE484: Sensors and Sensor Systems
EE486: Integrated Circuit Fabrication Technology
(cross-listed with MSE486; only EE enrollment shown)

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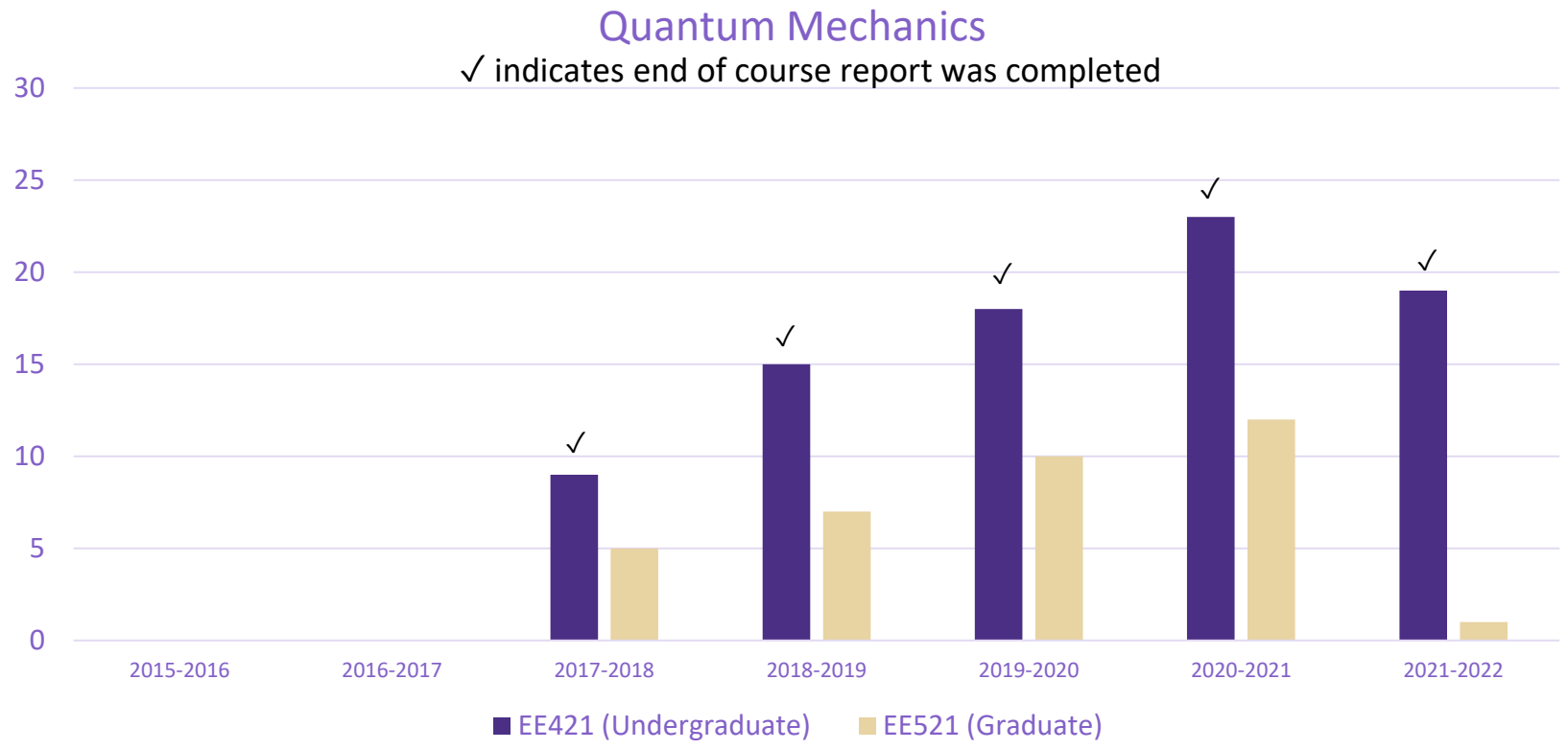
Advanced Electronic and Photonic Devices Course Enrollment (Quantum Mechanics Courses)



EE421: Quantum Mechanics for Engineers (undergraduate)
EE521: Quantum Mechanics for Engineers (graduate)

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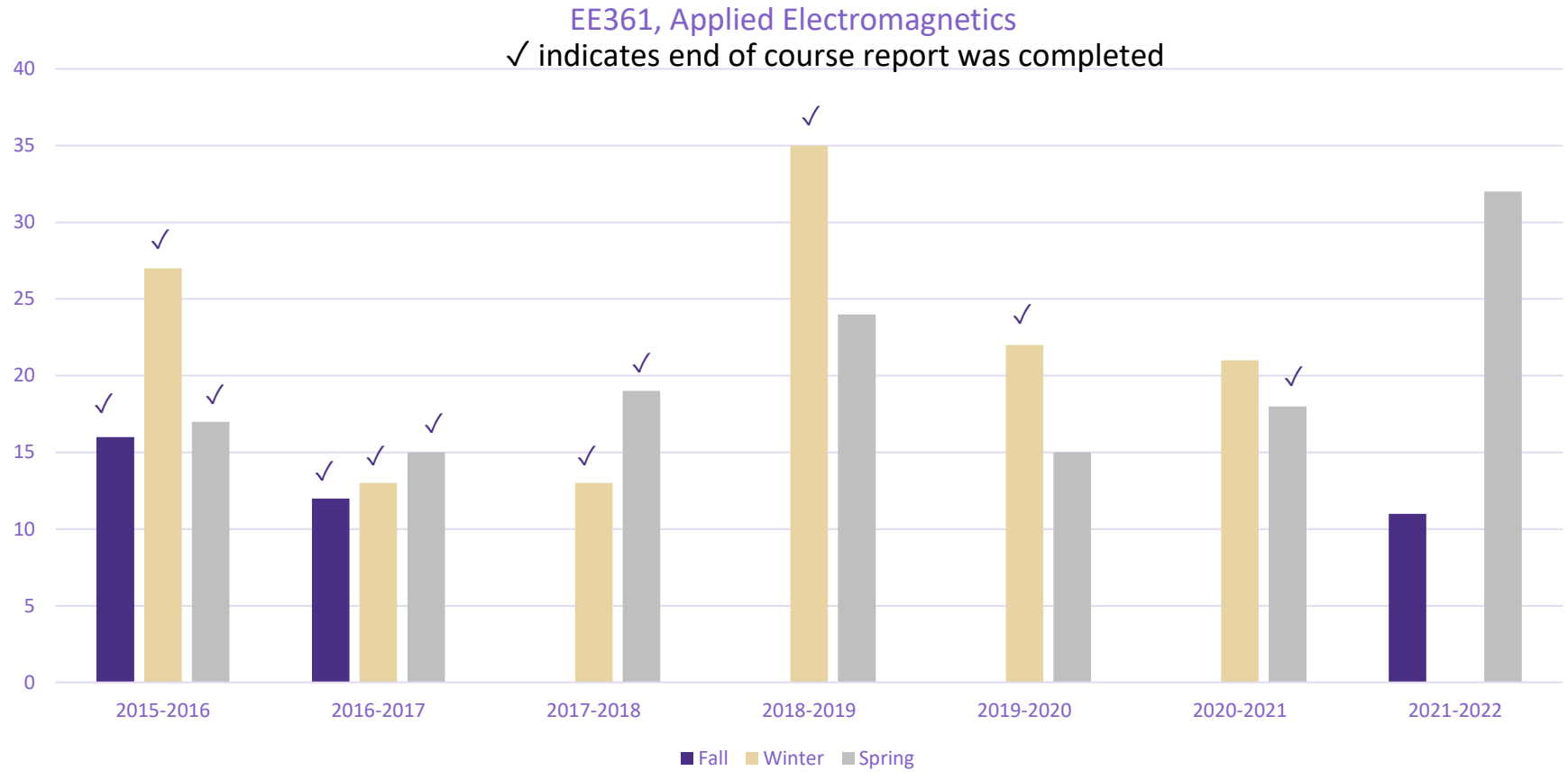
EE3XX Prerequisite Enrollments for Advanced Electronic and Photonic Devices



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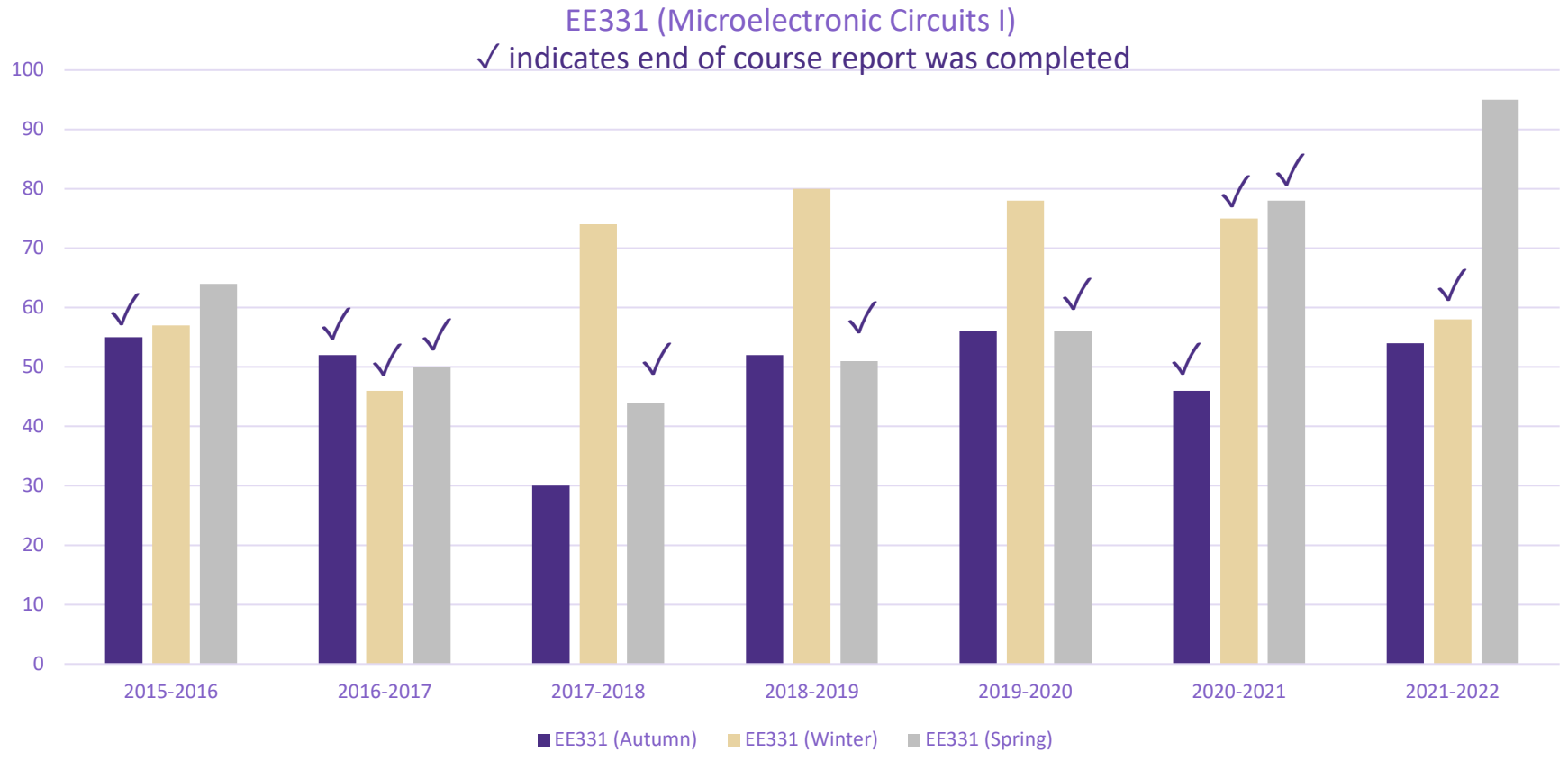
EE3XX Prerequisite Enrollments for Advanced Electronic and Photonic Devices



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Advanced Electronic and Photonic Devices
End of Course Outcomes

In follow-up with Prof. Anantram, he stated that this class was no different than previous offerings and this data point appears to be simply an anomaly.

EE482: Semiconductor Devices

	2018-2019	2019-2020	2020-2021	2021-2022
Outcome #1 (Solve Engineering Problems))				
Total Students Evaluated	3	3	3	10
Novice/Developing/Competent/Exemplary	0/0/2/1	0/0/2/1	0/0/1/2	4/4/2/0
Percentage Competent or Exemplary	100%	100%	100%	20%
Outcome #6 (Experimentation)				
Total Students Evaluated	UA			
Novice/Developing/Competent/Exemplary	UA			
Percentage Competent or Exemplary	UA			

UA: Unable to Assess

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Advanced Electronic and Photonic Devices
End of Course Outcomes

In follow-up with Prof. Lin, she stated that this was a function of problem selection, not overall performance of the students.

EE485: Introduction to Photonics

	2018-2019	2019-2020	2020-2021	2021-2022
Outcome #1 (Solve Engineering Problems))				
Total Students Evaluated	3	3	3	
Novice/Developing/Competent/Exemplary	0/0/2/1	0/1/1/1	0/1/1/1	0/1/1/4
Percentage Competent or Exemplary	100%	67%	67%	83%
Outcome #6 (Experimentation)				
Total Students Evaluated	3			
Novice/Developing/Competent/Exemplary	0/1/1/1			
Percentage Competent or Exemplary	67%			
Outcome #7 (Acquire New Knowledge)				
Total Students Evaluated		3	3	
Novice/Developing/Competent/Exemplary		1/0/1/1	1/1/1/0	0/1/0/5
Percentage Competent or Exemplary		67%	33%	83%

Advanced Electronic and Photonic Devices
End of Course Outcomes

EE484: Sensors and Sensor Systems

	2018-2019	2019-2020	2020-2021	2021-2022
Outcome #2 (Engineering Design)				
Total Students Evaluated	6	N/A	6	Spring offering
Novice/Developing/Competent/Exemplary	0/0/3/3	N/A	0/1/5/0	
Percentage Competent or Exemplary	100%	N/A	83%	
Outcome #3 (Communication)				
Total Students Evaluated	6	N/A	6	Spring offering
Novice/Developing/Competent/Exemplary	0/0/0/6	N/A	0/1/3/2	
Percentage Competent or Exemplary	100%	N/A	83%	
Outcome #5 (Teamwork)				
Total Students Evaluated	6	N/A	6	Spring offering
Novice/Developing/Competent/Exemplary	0/3/0/3	N/A	1/0/3/2	
Percentage Competent or Exemplary	50%	N/A	83%	

Advanced Electronic and Photonic Devices Changes and Continuing Challenges

Course	Notes
EE331	Too much content coverage; EE280 (Exploring Devices) will allow more time for circuits coverage
EE361	Student inexperience with vector calculus slows the class down
EE421/EE521	Students would benefit from previous exposure to scientific computing
EE482/EE539A	Content is disjointed and too much ground is covered in one quarter; course was revised in Autumn 2020 to provide more time spent on relevant devices.
EE421/EE521	Students would benefit from previous exposure to scientific computing
EE484	Taught as non-capstone offering in Spring 2019, Spring 2021, and Spring 2022 Some students pushed back at needing to understand fundamental sensor operation in Spring 2019, but this problem did not re-emerge in Spring 2021.
EE485	Too much content coverage was addressed by introducing Advanced Photonics Course; EE487/EE587 (Intro to Photonics) and EE488/EE588 (Advanced Photonics) will be offered starting in Autumn 2022 to allow cross-listing as a graduate course and better content coverage
EE486	Over half of students are MSE (MSE486) but MSE never teaches the course. Possibility of cancelling the course should be discussed in Curriculum Committee.

Advanced Electronic and Photonic Devices Student Evaluations of Teaching (2019-2022)

Pre-Requisites to 4XX courses in Advanced Electronic and Photonic Devices

	A19	W20	Sp20	A20	W21	Sp21	A21	W22	Sp22
EE331									
Course as a Whole	4.7	4.7	3.5	3.8	2.4	4.6	4.8	4.4	
Course Content	4.6	4.5	3.6	3.9	3.0	4.7	4.7	4.5	
Amount Learned	4.8	4.6	NA	NA	NA	NA	4.6	4.1	
EE361									
Course as a Whole		4.2	3.8		4.2	4.5	4.3		
Course Content		4.3	3.8		4.2	4.5	4.1		
Amount Learned		4.0	NA		NA	4.7	4.5		

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Advanced Electronic and Photonic Devices Student Evaluations of Teaching (2019-2022)

4XX courses in Advanced Electronic and Photonic Devices

	2019-2020	2020-2021	2021-2022
EE421/EE521			
Course as a Whole	4.50	4.94	
Course Content	4.33	4.94	
Amount Learned	4.63	N/A	
EE482/EE539			
Course as a Whole	4.00	4.38	
Course Content	3.75	4.63	
Amount Learned	4.33	5.00	
EE484/EE539			
Course as a Whole	4.00		TBD
Course Content	3.75		TBD
Amount Learned	4.13		TBD

Advanced Electronic and Photonic Devices Student Evaluations of Teaching (2019-2022)

4XX courses in Advanced Electronic and Photonic Devices

	2019-2020	2020-2021	2021-2022
EE485			
Course as a Whole	3.67	4.25	
Course Content	3.92	4.25	
Amount Learned	3.92	4.67	
EE486			
Course as a Whole		2.2	
Course Content		4.1	
Amount Learned		3.0	

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Advanced Electronic and Photonic Devices Concentration Area Enrollment

AEP had 9 students in the concentration area in 2019-2020; 8 in 2020-2021; and 9 in 2021-2022. Still, these numbers represent less than 5% of our graduates. But enrollments for 4XX level courses in AEP tend to have sufficient enrollment. The logical conclusion is that AEP courses have a reason to remain despite the fact that our undergraduates don't often choose AEP as their concentration.

Semiconductor devices (EE482, EE421) are likely to remain important especially as transistors shrink and reach the end of Moore's law in their present form. Photonics (EE485) are highly relevant to the future and escalating interest in AR/VR is increasing jobs in this area and Meta is increasingly hiring our students for devices and photonics expertise. Sensors (EE484) will continue to grow in standalone systems and in networked, IoT, and embedded systems. All of these courses are moving toward concurrent graduate/undergraduate offerings.

In the new curriculum, we anticipate that students will take these courses standalone depending on individual interest and a smaller proportion of students will opt for the pathways designed around devices courses. Also for the new curriculum, new "hot topics" in Fourier and Geometric optics, Physical Optics, and Optics for the Metaverse are in the works. We are also looking at "Contemporary Topics in XXX" courses that would allow flexibility in the new curriculum.