

Request to Add Graduate Minor

Office of Graduate Enrollment Services; The Pennsylvania State University; 114 Kern Building; University Park, PA 16802-3396; (814) 865-1795; Fax: (814) 863-4627

Note: Master's minors require a minimum of six total credits with at least three of those credits at the 500-level or higher. Doctoral minors require a minimum of 15 credits with at least six of those credits at the 500-level or higher. Please refer to the Graduate Degree Programs Bulletin at <http://bulletins.psu.edu/bulletins/whitebook/index.cfm> for more information.

PSU ID# _____ Student's Last Name _____ Student's First Name, Middle Initial _____

E-mail Address _____ Major Field of Study _____ Minor Field Requested _____

Is the minor to be associated with a doctoral or master's degree (check one)? Doctoral Degree¹ Master's Degree

This student is taking the following courses which will be used to satisfy the minor:

Course Code	Course Number	Course Title	# of Credits
Total Credits:			

APPROVAL SIGNATURES

Student Signature Date _____

Minor Program Representative (Print) Date _____

Minor Program Representative Signature

Major Program Head/Graduate Officer (Print) Date _____

Major Program Head/Graduate Officer Signature

Graduate Enrollment Services Director Signature Date _____

Completed form is to be submitted to Graduate Enrollment Services in 114 Kern Building so the minor may be added to the student's official record.

¹ Note: According to academic policy, a doctoral minor consists of integrated or articulated work in one field related to, but different from that of the major. At least one member of the minor field must be on the candidate's doctoral committee. As such, approval for and addition of an intended minor should be pursued early in a doctoral student's program (prior to the comprehensive examination) in order to ensure that the intended minor is appropriate, its integration/articulation with the major field can be rationalized, and that the doctoral committee member representing the minor field is an active participant in all aspects of the committee's efforts to inform the student's program and dissertation research. Consequently, a request to add a minor at the end stage of a doctoral student's program should justify how the above intent has been achieved.



COURSE REQUIREMENTS
for
MASTERS DEGREE WITH MINOR IN OPERATIONS RESEARCH

PREREQUISITES:

- I Calculus (MATH 140,141)
- II Linear Algebra (MATH 220)
- III Computer Programming (CMPSC 101, 201 or 203)
- IV Probability and Statistics (3 credits)

Colloquium requirements: students must enroll in OR 590 Colloquium for 1 credit in each year enrolled in the major graduate program and in residence. The maximum number of OR 590 credits required for a Master’s degree with a minor in OR is 2.

Note: some classes are considered equivalent within and across departments. When classes are equivalent, only one can count towards the credit requirements of a specific area and sub-area. Equivalent classes are listed in the Appendix.

REQUIREMENTS: (9 Credits Minimum, at Least 3 Credits at the 500 Level, and at Least 6 Credits Must be in Addition to Graduate Major Requirements):

STOCHASTIC METHODS/STATISTICAL METHODS (3 credits minimum)		
<u>Statistical Methods</u>	<u>Stochastic Processes</u>	Credits taken
ECON: 501	EE: 560	
ECON/EEFE: 510,511	IE/SC&IS: 516	
IE: 511, 532, 555, 583, 584	MATH/STAT: 416, 516, 519	
MATH/STAT: 414, 415, 418	ME: 577	
SC&IS: 535	STAT: 515	
STAT: 460, 501, 502, 503		

OPTIMIZATION (3 credits minimum)		
<u>Linear Optimization</u>	<u>Deterministic Optimization</u>	Credits taken
EEFE: 527	CHE: 512	MATH: 486
IE: 405, 505	CSE/MATH: 555	ME: 444
MATH: 484	ECON: 534	SC&IS: 525
	IE: 468, 510, 512, 520	
	521, 525, 588, 589	
<u>Stochastic Optimization</u>		Credits taken
IE/SC&IS: 519		

COMPUTATIONAL METHODS (3 credits minimum)		
<u>Numerical Methods</u>	<u>Simulation Methods</u>	Credits taken
CMPSC/MATH: 451, 455, 456	IE: 453, 522, 540	
CSE/MATH: 550, 553	SC&IS: 545	
<u>Data Analytics/ Data Science</u>		Credits taken
BAN: 540	EE: 456, 556, 582	
CMPSC: 410, 448	IE: 561, 562, 575, 582	
CSE: 584	IST/STAT: 557, 558	

OPEN AREAS – APPLICATIONS / SPECIALIZATION*			
			Credits taken
ABE: 559	EE: 581	ME: 526, 565	
BRS: 429W	EEFE: 530, 531, 532	MKTG: 555	
CE: 525	ERM: 412	PNG: 430, 511, 512	
CMPEN: 431	GEOG: 560	SC&IS: 505, 510, 520, 530,	
CMPSC: 431W, 442, 465	IE: 402,425, 454, 507, 509,	546, 565,	
CSE: 556, 562, 564, 565	566, 570	STAT: 510, 513, 514, 540	
ECON: 500, 521, 589	MATH: 485		

*In addition to the courses listed above, students may include any appropriate level courses in information systems, quality control, scheduling, inventory, queueing, decision analysis, game theory, graph theory, supply chain, expert systems, econometrics, forecasting or other relevant topics.

APPENDIX

NEW CLASSES PRE-APPROVED FOR OR CREDITS:

The following classes are new or given infrequently and thus do not have a unique numerical designation. These courses are pre-approved to be used for credits in the following application areas. Some additional 497 and 597 “Special Topics” classes may be approved and not listed here. Please refer to the OR Program website for the updated list.

STOCHASTIC METHODS/STATISTICAL METHODS	
<u>Stochastic Processes</u>	Credits taken
IE: 597X <i>Advanced Stochastic Processes</i>	
OPTIMIZATION	
<u>Linear Optimization</u>	Credits taken
IE: 597X <i>Advanced Linear Programming**</i>	
<u>Deterministic Optimization</u>	Credits taken
IE: 597X <i>Convex Optimization</i>	
<u>Stochastic Optimization</u>	Credits taken
IE: 597X <i>Stochastic Optimization</i> 597X <i>Robust Optimization</i>	
COMPUTATIONAL METHODS	
<u>Numerical Methods</u>	Credits taken
CE: 597X <i>Computational Analysis of Randomness in Engineering</i>	
<u>Data Analytics/Data Science</u>	Credits taken
CSE: 597X <i>Advanced Big Data Analytics</i> 597X <i>Data Mining Analytics</i>	
IST: 597X <i>Big Data Fundamentals</i>	
OPEN AREAS – APPLICATIONS / SPECIALIZATION	
CE: 597X <i>Design of Public Transportation</i> 597X <i>Infrastructure Asset Management</i>	Credits taken
GEOG: 497X <i>Spatial Network Analysis</i>	
IE: 597X <i>Optimization in Modern Data</i>	

** See Equivalent Classes List.

EQUIVALENT CLASSES:

The following classes are considered equivalent with respect to the Operations Research degree qualification. Only one course from each bullet point below can be used for credits towards the Operations Research course requirements.

Stochastic Methods / Statistical Methods:

- MATH 416, IE 516

Optimization

- IE 405, MATH 484
- IE 505, IE 597 (Advanced Linear Programming)
- IE 468, CHE 512
- MATH 486, ECON 534

Computational Methods

- CMPS/C/MATH 451, CMPS/C/MATH 455

RESTRICTIONS FOR UNDERGRADUATE CLASSES:

Students cannot use credits from classes that are required courses in the undergraduate curriculum of their major graduate program. For example, Industrial Engineering students cannot select IE 405, IE 425 or IE 453.