

**REQUEST  
for  
Ph.D. DUAL-TITLE DEGREE IN OPERATIONS RESEARCH**

**Students:** Fill in this application as applicable. Have the form signed by the Professor-in-Charge of the Graduate Major Program and forward it to the Chairperson of Operations Research. The Committee on Operations Research will approve or disapprove the request. The Graduate School will be notified if the request is approved.

**Name** \_\_\_\_\_  
Last
First
Middle name initial

**PSU-ID** \_\_\_\_\_ **E-mail** \_\_\_\_\_

**Graduate Program Major** \_\_\_\_\_

**B.A./B.S.** \_\_\_\_\_  
Degree
Major
Institution
Date

**M.A./M.S.** \_\_\_\_\_  
Degree
Major
Institution
Date

**Request for Program Admittance Approved  
by Professor-in-Charge of Graduate Major**

**Request for Program Admittance Approved  
by Chairperson, Operations Research**

\_\_\_\_\_  
Signature
Date

\_\_\_\_\_  
Signature
Date

**Doctoral Committee<sup>1</sup>:** In addition to the general Graduate Council requirements for doctoral committees, the chair and at least two members of the doctoral committee of an OR dual-title Ph.D. student must be members of the OR Graduate Faculty. One of these two members should be the external member in the student’s doctoral committee. Faculty members who hold appointments in both programs’ Graduate Faculty may serve in a combined role.

**Chair Person:** \_\_\_\_\_  
**Member Outside Graduate Major Program:** \_\_\_\_\_  
**Member:** \_\_\_\_\_  
**Member:** \_\_\_\_\_  
**Member (Optional):** \_\_\_\_\_

**Admitted to Ph.D. Candidacy:** \_\_\_\_\_  
Month/Day/Year

**Passed Ph.D. Comprehensive:** \_\_\_\_\_  
Month/Day/Year

**Dissertation**  
**Title** \_\_\_\_\_  
**Date Accepted** \_\_\_\_\_

<sup>1</sup> The information below does not have to be filled in if not known at the time of application.  
 1 of 3

**COURSE REQUIREMENTS**  
for  
**Ph.D. DUAL-TITLE DEGREE 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)

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**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 Ph.D. dual title student is 4.

**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: (36 Credits Minimum, at Least 18 credits at the 500 Level):**

STOCHASTIC METHODS/STATISTICAL METHODS (9 credits minimum)		
Statistical Methods (3 credits min)	Stochastic Processes (3 credits min)	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 (9 credits minimum)		
Linear Optimization (3 credits min)	Deterministic Optimization	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	
Stochastic Optimization		Credits taken
IE/SC&IS: 519		

COMPUTATIONAL METHODS (6 credits minimum)		
Numerical Methods	Simulation Methods (3 credits min)	Credits taken
CMPSC/MATH: 451, 455, 456	IE: 453, 522, 540	
CSE/MATH: 550, 553	SC&IS: 545	
Data Analytics/ Data Science		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* (12 credits minimum)			
Area 1	Area 2	Area 3	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.

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

- MATH/CMPSC 451, MATH/CMPSC 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.