

**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 Committee¹: 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 outside unit (external) member in the student’s doctoral committee. Faculty members who hold appointments in both programs’ Graduate Faculty may serve in a combined role. The OR representatives on the student’s doctoral committee will develop questions for and participate in the evaluation of the comprehensive examination.

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 _____

¹ The information below does not have to be filled in if not known at the time of application.

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)

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.

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

STOCHASTIC METHODS/STATISTICAL METHODS (9 credits minimum)		
<i>Statistical Methods (3 credits min)</i>	<i>Stochastic Processes (3 credits min)</i>	Credits taken
ECON: 501	EE: 560	
ECON/EEFE: 510	IE/SC&IS: 516	
IE: 511, 532, 583, 584	MATH/STAT: 416, 516, 519	
MATH/STAT: 414, 415, 418	ME: 577	
SC&IS: 535	METEO: 527	
STAT: 460, 501, 502, 503, 553, 561, 562	STAT: 515	

OPTIMIZATION (9 credits minimum)		
<i>Linear Optimization (3 credits min)</i>	<i>Deterministic Optimization</i>	Credits taken
EEFE: 527	CHE: 512	IE/EE: 585
IE: 405, 505	CSE/MATH: 555	MATH: 484, 485, 486
	ECON: 534	ME: 444
	IE: 468, 510, 512, 520, 521, 588, 589	SC&IS: 525
<i>Stochastic Optimization</i>		Credits taken
EME: 523	IE: 513	IE/SC&IS: 519

COMPUTATIONAL METHODS (6 credits minimum)		
<i>Numerical Methods</i>	<i>Simulation Methods (3 credits min)</i>	Credits taken
CMPSC/MATH: 451, 455, 456	GEOG: 485	IE: 453, 522
CSE/MATH: 550, 553	GEOSC: 561	SC&IS: 545
<i>Data Analytics/ Data Science</i>		Credits taken
BAN: 541, 550, 830	EE: 456, 556, 582	IE: 562, 575, 582
CMPSC: 410, 448	EME: 524	IST/STAT: 557, 558
CSE/EDSGN/IE/IST: 561	GEOG: 463, 465, 580, 586	MKTG: 540
CSE/STAT: 584	GEOSC: 514	STAT: 508

OPEN AREAS – APPLICATIONS / SPECIALIZATION* (12 credits minimum)		
		Credits taken
ABE: 559	EEFE: 530, 531, 532	ME: 565
BRS: 429W	EME: 522	MKTG: 555
CE: 521, 525, 529	EMSC: 482	PHYS: 580
CMPEN: 431	ERM: 412	PNG: 430, 511, 512
CMPSC: 431W, 442, 465	GEOG: 464, 479, 560, 850, 855, 858	SC&IS: 505, 510, 520, 530, 546, 565, 570
CSE: 556, 562, 564, 565	GEOSC: 450	STAT: 510, 513, 514, 540, 551, 552
ECON: 402, 500, 521, 589	IE: 402, 425, 454, 478, 507, 509, 517, 530, 566, 567, 568, 570	
EE: 567, 580, 581		
EE/ME: 550		

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

APPENDIX

NEW PRE-APPROVED COURSES TO SATISFY OR CREDIT REQUIREMENTS:

The following courses are either 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 areas or sub-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>Stochastic Optimization</u>	Credits taken
IE: 597X <i>Robust Optimization</i>	
COMPUTATIONAL METHODS	
<u>Numerical Methods</u>	Credits taken
CE: 597X <i>Computational Analysis of Randomness in Engineering</i>	
GEOSC: 597X <i>Multivariate Analysis in Geosciences</i>	
<u>Data Analytics/Data Science</u>	Credits taken
CSE: 597X <i>Advanced Big Data Analytics</i>	
597X <i>Data Mining Analytics</i>	
EMSC: 497X <i>Environmental Data Analytics</i>	
IST: 597X <i>Big Data Fundamentals</i>	
OPEN AREAS – APPLICATIONS / SPECIALIZATION	
CE: 597X <i>Design of Public Transportation</i>	Credits taken
EMSC: 497X <i>Earth and Mineral Sciences</i>	
GEOSC: 497X <i>Data Visualization for Scientists and Engineers</i>	
IE: 597X <i>Optimization in Modern Data</i>	
STAT: 597X <i>Functional Data Analysis</i>	
EE: 597X <i>Reinforcement Learning</i>	

** See Equivalent Courses List.

EQUIVALENT COURSES:

Some courses are considered equivalent within and across departments. When courses are equivalent, only one can be taken for credit to satisfy the OR course requirements in a specific area and sub-area.

The following courses are considered equivalent with respect to the OR degree qualification. Only one course from each bullet point below can be used for credit towards the OR course requirements.

Stochastic Methods / Statistical Methods:

- MATH/STAT 416, IE/SC&IS 516

Optimization

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

Computational Methods

- CMPSC/MATH 451, CMPSC/MATH 455

RESTRICTIONS FOR UNDERGRADUATE COURSES:

Students cannot use credits from courses 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.