Information on required courses for the Doctoral Concentration in Complex Adaptive Systems Science

	Courses for the Environmental Social	Science	Credit Hours
<u>Degree</u>			
(Prefix & Number)	(Course Title)	(New Course?) Yes or No?	(Insert Section Sub-total)
ESS501	Environmental Social Science: Theory and Practice I	no	3
ESS502	Environmental Social Science: Theory and Practice II	no	3
ASM579 or equivalent	Proposal writing or equivalent	no	3
Three of the Following	Three courses covering the methods and theories of the topical foci of ESS		
ESS510 ESS511	Urban Environments Origins and Consequences of Technologies	No No	3 3
ESS512 ESS513 ESS514	Landscapes Institutions, Society and the Environment Health and the Environment	No No No	3 3 3
One of the Following	Course with the specific focus determined based on the student's interest and research plan		
SSH603 SSH591	Research Design and Proposal Writing in Social Science and Health Research Design and Proposal Writing in Anthropology	No No	3
	Two courses that provide intensive background in some area of science	No	6
	Electives	no	6
ESS792/799	Research/Dissertation Hours	no	24
	Required Concentration Courses		Credit Hours
(Prefix & Number)		(New Course?) Yes or No?	(Insert Section Sub-total)
ASM591/ BIO591/ APM591	Fundamentals of CASS	no	3-4
One of the following AML610 AML 591	One course in mathematics of CASS Topics in Applied Mathematics for the Life and Social Sciences Probability Theory or equivalent	no	3

	One course in modeling CASS Choose from		
One of the following	Applied Mathematics for the Life and Social Sciences Modeling Seminar		
AML612	Agent Based Modeling		
AML591	Dynamic Modeling in Social and		
ASM591	Ecological Systems	no	3-4
PUP598	Modeling and Simulating Urban Environments	110	
CES561	Modeling & Simulation Theory &		
PAF591	Application		
BIO545	Introduction to Policy Informatics		
	Populations: Evolutionary Genetics		
	or equivalent		
	One course in application of CASS approaches. Choose from		
One of the following	Readings in Complexity		
ASM591/BIO 591	Complexity in Public Policy & Management		
PAF591	Social Network Analysis		
SOS598	Dynamics in Psychology		
PSY576	Dynamics in Perception, Action, &	no	3
PSY598	Cognition		
ANB502	Current Issues in Animal Behavior		
BIO591	Topics in Mathematics for Life and Sustainability Science		
BIO522	Populations: Evolutionary Ecology		
	or equivalent		
	Elective or Research Courses		
(as dee	med necessary by supervisory committed	e)	Credit Hours
(Prefix & Number)	(Course Title)	(New Course?) Yes or No?	(Insert Section Sub-total)
	Research (CASS related)	no	3
	Research (degree related)	no	9
	Culminating Experience project, applied project, thesis (masters only ertation (doctoral only – 12 credit hours) as a		Credit Hours (Insert Section Sub-total)
	Doctoral Dissertation		12

Other Requirements E.g Internships, clinical requirements, field studies as applicable	Credit Hours (Insert Section Sub-total)
For doctoral programs – as approved by the student's supervisory committee, the program can allow 30 credit hours from a previously awarded master's degree to be used for this program. As applicable, please indicate the total credit hour allowance that will be used for this program.	45-47
Total required credit hours	

Required Core C	Credit Hours		
(Prefix & Number)	(Course Title)	(New Course?) Yes or No?	(Insert Section Sub-total)
ASB591/ SSH510	Health: Social and Bio-cultural Theories	no	3
ASB500 or equivalent	Ethnographic Research Methods	no	3
SSH511,	Ethics, Social Justice, and Health Social Science	No	3
ASB591, or equivalent	Poverty, Social Justice, and Global Health	No	3
equivalent	Or Equivalent	no	3
	A research design/proposal writing course	No	3
	At least two advanced statistical courses	no	6
	At least one advanced course in epidemiology		3
	At least two additional methods courses		6
	A relevant community-based internship/practicum		
	A foreign language		
	Required Concentration Courses		Credit Hours
(Prefix & Number)	(Course Title)	(New Course?) Yes or No?	(Insert Section Sub-total)
ASM591/ BIO591/ APM591	Fundamentals of CASS	no	3-4
One of the following	One course in mathematics of CASS		
AML610	Topics in Applied Mathematics for the Life and Social Sciences	no	3
AML 591	Probability Theoryor equivalent		

Applied Mathematics for the Life and Social Sciences Modeling Seminar AML612 Agent Based Modeling AML591 Dynamic Modeling in Social and Ecological Systems Modeling and Simulating Urban Environments Modeling & Simulation Theory & Application BIO545 Introduction to Policy Informatics Populations: Evolutionary Genetics or equivalent One of the following ASM591/BIO 591 Complexity in Public Policy & Management PAF591 Social Network Analysis SOS598 Dynamics in Psychology PSY576 Dynamics in Perception, Action, & Cognition BIO522 Populations: Evolutionary Ecology BIO591 Topics in Mathematics for Life and Sustainability Science Populations: Evolutionary Ecology or equivalent Elective or Research Courses (as deemed necessary by supervisory committee) Elective or Research Courses (as deemed necessary by supervisory committee) Research (CASS related) Research (CGASS related) Research (Gagree related) Doctoral Dissertation Doctoral Dissertation 12		One course in modeling CASS Choose from		
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PUP598 CES561 PAF591 BIO545 Introduction to Policy Informatics Populations: Evolutionary Geneticsor equivalent One of the following ASM591/BIO 591 PAF591 Social Network Analysis SOS598 Dynamics in Psychology PSY576 Dynamics in Perception, Action, & Cognition BIO591 BIO591 BIO592 BIO592 BIO592 BIO592 Research Course (Prefix & Number) (Course Title) Culminating Experience E.g Capstone project, applied project, thesis (masters only – 6 credit hours) or dissertation (doctoral only – 12 credit hours) as applicable	AML591			
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Populations: Evolutionary Geneticsor equivalent One course in application of CASS approaches. Choose from One of the following ASM591/BIO 591 PAF591 Social Network Analysis Dynamics in Psychology PSY576 Dynamics in Perception, Action, & Cognition Current Issues in Animal Behavior Topics in Mathematics for Life and Sustainability Science Populations: Evolutionary Ecologyor equivalent Elective or Research Courses (as deemed necessary by supervisory committee) (New Course?) Yes or No? Research (CASS related) Research (degree related) Research (degree related) Culminating Experience E.g Capstone project, applied project, thesis (masters only – 6 credit hours) or dissertation (doctoral only – 12 credit hours) as applicable	PAF591			
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One of the following ASM591/BIO 591 PAF591 Social Network Analysis Dynamics in Psychology PSY576 PSY598 ANB502 BIO522 BIO522 BIO522 Elective or Research Courses (as deemed necessary by supervisory committee) Elective or Research Courses (as deemed necessary by supervisory committee) Elective or Research (CASS related) Research (degree related) Research (degree related) Culminating Experience E.g Capstone project, applied project, thesis (masters only – 6 credit hours) or dissertation (doctoral only – 12 credit hours) as applicable		Populations: Evolutionary Genetics		
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SOS598 PSY576 PSY598 ANB502 BIO591 BIO522 Populations: Evolutionary Ecology or equivalent Course Title Research (CASS related) Research (degree related) Research (degree related) Research Sub-total)	PAF591			
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ANB502 BIO591 BIO522 Topics in Mathematics for Life and Sustainability Science Populations: Evolutionary Ecologyor equivalent Elective or Research Courses (as deemed necessary by supervisory committee) (Prefix & Number) (Course Title) Research (CASS related) Research (degree related) Research (degree related) Culminating Experience E.g Capstone project, applied project, thesis (masters only – 6 credit hours) or dissertation (doctoral only – 12 credit hours) as applicable	PSY598	Cognition		
Sustainability Science Populations: Evolutionary Ecologyor equivalent Elective or Research Courses (as deemed necessary by supervisory committee) (Prefix & Number) (Course Title) Research (CASS related) Research (degree related) Research (degree related) Credit Hours (Insert Section Sub-total) Research (degree related) Credit Hours Culminating Experience E.g Capstone project, applied project, thesis (masters only – 6 credit hours) or dissertation (doctoral only – 12 credit hours) as applicable	ANB502	Current Issues in Animal Behavior		
Populations: Evolutionary Ecology or equivalent	BIO591			
Elective or Research Courses (as deemed necessary by supervisory committee) (Prefix & Number) (Course Title) Research (CASS related) Research (degree related) Culminating Experience E.g Capstone project, applied project, thesis (masters only – 6 credit hours) or dissertation (doctoral only – 12 credit hours) as applicable Credit Hours (Insert Section Sub-total) Credit Hours (Insert Section Sub-total)	BIO522	•		
(Prefix & Number) (Prefix & Number) (Course Title) Research (CASS related) Research (degree related) Culminating Experience E.g Capstone project, applied project, thesis (masters only hours) or dissertation (doctoral only – 12 credit hours) as applicable (New Course?) Yes or No? (Insert Section Sub-total) Credit Hours (Insert Section Sub-total)				
(Prefix & Number) (Prefix & Number) (Course Title) Research (CASS related) Research (degree related) Culminating Experience E.g Capstone project, applied project, thesis (masters only hours) or dissertation (doctoral only – 12 credit hours) as applicable (New Course?) Yes or No? (Insert Section Sub-total) Credit Hours (Insert Section Sub-total)		Elective or Research Courses		
(Prefix & Number) (Course Title) Research (CASS related) Research (degree related) Research (degree related) Culminating Experience E.g Capstone project, applied project, thesis (masters only – 6 credit hours) or dissertation (doctoral only – 12 credit hours) as applicable Sub-total)	(as dee		e)	Credit Hours
Research (degree related) Culminating Experience E.g Capstone project, applied project, thesis (masters only – 6 credit hours) or dissertation (doctoral only – 12 credit hours) as applicable Credit Hours (Insert Section Sub-total)	(Prefix & Number)	(Course Title)	Course?) Yes or	•
Culminating Experience E.g Capstone project, applied project, thesis (masters only – 6 credit hours) or dissertation (doctoral only – 12 credit hours) as applicable Credit Hours (Insert Section Sub-total)		Research (CASS related)	no	3
Culminating Experience E.g Capstone project, applied project, thesis (masters only – 6 credit hours) or dissertation (doctoral only – 12 credit hours) as applicable (Insert Section Sub-total)		Research (degree related)	no	9
Doctoral Dissertation 12	E.g Capstone project, applied project, thesis (masters only – 6 credit			`
		Doctoral Dissertation		12
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Other Requirements E.g Internships, clinical requirements, field studies as applicable	Credit Hours (Insert Section Sub-total)
For doctoral programs — as approved by the student's supervisory committee, the program can allow 30 credit hours from a previously awarded master's degree to be used for this program. As applicable, please indicate the total credit hour allowance that will be used for this program.	45-47
Total required credit hours	

Required Core	Courses for the PhD in Sustainability	Degree	Credit Hours
(Prefix & Number)	(Course Title)	(New Course?) Yes or No?	(Insert Section Sub-total)
SOS510	Perspectives on Sustainability	no	3
SOS511	Introduction to Research Methods in Sustainability	no	3
SOS512 SOS513 SOS514 SOS515 SOS516 SOS591 SOS591	In addition, students must take 6 hours of the following if admitted with a Master's Degree and 9 hours with a Bachelor's Degree Sustainable Resource Allocation Science for Sustainability Human Dimensions of Sustainability Industrial Ecology and Design for Sustainability Science, Technology and Public Affairs Uncertainty and Decision Making Sustainability and Enterprise	No, for all	3 for all
SOS530 SOS532 SOS533 SOS534 SOS535 SOS536 SOS591 SOS598	At least one Challenge Area Seminar: International Development and Sustainability Sustainable Urban Dynamics Sustainable Water Sustainable Energy and Material Use Sustainable Ecosystems Food System Sustainability Legal Issues in Sustainability Urban Ecological Systems	No, for all	3 for all (except 4 for SOS535)
	Required Solutions Workshop	no	3
SOS792/799	Required Research and Dissertation	no	24
	Required Concentration Courses	I	Credit Hours
(Prefix & Number)	(Course Title)	(New Course?) Yes or No?	(Insert Section Sub-total)
ASM591/ BIO591/ APM591	Fundamentals of CASS	no	3-4
One of the following AML610 AML 591	One course in mathematics of CASS Topics in Applied Mathematics for the Life and Social Sciences Probability Theory or equivalent	no	3

	Choose from		
One of the following	Applied Mathematics for the Life and Social Sciences Modeling Seminar		
AML612	Agent Based Modeling		
AML591	Dynamic Modeling in Social and		
ASM591	Ecological Systems	no	3-4
PUP598	Modeling and Simulating Urban Environments	110	0 1
CES561	Modeling & Simulation Theory &		
PAF591	Application		
BIO545	Introduction to Policy Informatics		
	Populations: Evolutionary Genetics		
	or equivalent		
	One course in application of CASS approaches. Choose from		
One of the following	Readings in Complexity		
ASM591/BIO 591	Complexity in Public Policy & Management		
PAF591	Social Network Analysis		
SOS598	Dynamics in Psychology		
PSY576	Dynamics in Perception, Action, &	no	3
PSY598	Cognition		
ANB502	Current Issues in Animal Behavior		
BIO591	Topics in Mathematics for Life and Sustainability Science		
BIO522	Populations: Evolutionary Ecology		
	or equivalent		
	Elective or Research Courses		
(as deer	med necessary by supervisory committee	e)	Credit Hours
(Prefix & Number)	(Course Title)	(New Course?) Yes or No?	(Insert Section Sub-total)
	Research (CASS related)	no	3
	Research (degree related)	no	9
	Culminating Experience E.g Capstone project, applied project, thesis (masters only – 6 credit hours) or dissertation (doctoral only – 12 credit hours) as applicable		
	Doctoral Dissertation		12

Other Requirements E.g Internships, clinical requirements, field studies as applicable	Credit Hours (Insert Section Sub-total)
For doctoral programs – as approved by the student's supervisory committee, the program can allow 30 credit hours from a previously awarded master's degree to be used for this program. As applicable, please indicate the total credit hour allowance that will be used for this program.	45-47
Total required credit hours	

Required Core Courses for the PhD in Applied Mathematics for			Credit Hours
(Prefix & Number)	(Course Title)	(New Course?) Yes or No?	(Insert Section Sub-total)
AML610	Topics in AMLSS	no	3
AML611	Research Design and Proposal Writing	no	3
AML612	AMLSS Modeling Seminar	No	3
AML613	Probability and Stochastic Modeling for LSS	no	3
	One course in bio-statistics	no	3
	Elective and Research Courses At least 6 hours in the Life Sciences and 6 hours in the Social Sciences	no	12
	One course in Numerical Analysis	no	3
AML792	Dissertation Research	no	12
AML799	Dissertation	no	12
<u>!</u>	Required Concentration Courses		Credit Hours
(Prefix & Number)	(Course Title)	(New Course?) Yes or No?	(Insert Section Sub-total)
ASM591/ BIO591/ APM591	Fundamentals of CASS	no	3-4
One of the following AML610 AML 591	One course in mathematics of CASS Topics in Applied Mathematics for the Life and Social Sciences Probability Theory or equivalent	no	3

Applied Mathematics for the Life and Social Sciences Modeling Seminar AML612 Agent Based Modeling AML591 Dynamic Modeling in Social and Ecological Systems Modeling and Simulating Urban Environments Modeling & Simulation Theory & Application BIO545 Introduction to Policy Informatics Populations: Evolutionary Genetics or equivalent One of the following ASM591/BIO 591 Complexity in Public Policy & Management PAF591 Social Network Analysis SOS598 Dynamics in Psychology PSY576 Dynamics in Perception, Action, & Cognition BIO522 Populations: Evolutionary Ecology BIO591 Topics in Mathematics for Life and Sustainability Science Populations: Evolutionary Ecology or equivalent Elective or Research Courses (as deemed necessary by supervisory committee) Elective or Research Courses (as deemed necessary by supervisory committee) Research (CASS related) Research (CGASS related) Research (Gagree related) Doctoral Dissertation Doctoral Dissertation 12		One course in modeling CASS Choose from		
AML591 ASM591 PUP598 PUP598 CES561 PAF591 BIO545 One of the following ASM591/S91 PAF591 Social Network Analysis SOS598 PSY576 Dynamics in Perception, Action, & Cognition BIO522 BIO591 BIO522 Populations: Evolutionary Ecology BIO592 BIO592 Research (CASS related) Research (CASS related) Research (CGASS related) Research (GASS related) Research (GASS related) Research (Gase related) Research (Gase related) Culminating Experience E.g Capstone project, applied project, thesis (masters only – 6 credit hours) or dissertation (doctoral only – 12 credit hours) as applicable Modeling and Social and Ecological Systems Modeling and Simulation Urban Book application Theory & App				
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PUP598 CES561 PAF591 BIO545 Introduction to Policy Informatics Populations: Evolutionary Geneticsor equivalent One of the following ASM591/BIO 591 PAF591 Social Network Analysis SOS598 Dynamics in Psychology PSY576 Dynamics in Perception, Action, & Cognition BIO591 BIO591 BIO592 BIO592 BIO592 BIO592 Research Course (Prefix & Number) (Course Title) Culminating Experience E.g Capstone project, applied project, thesis (masters only – 6 credit hours) or dissertation (doctoral only – 12 credit hours) as applicable	AML591			
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CES561 PAF591 BIO545 Modeling & Simulation Theory & Application Introduction to Policy Informatics Populations: Evolutionary Geneticsor equivalent One of the following ASM591/BIO 591 PAF591 Social Network Analysis SOS598 Dynamics in Psychology PSY576 Dynamics in Perception, Action, & Cognition Current Issues in Animal Behavior Topics in Mathematics for Life and Sustainability Science Populations: Evolutionary Ecologyor equivalent Elective or Research Courses (as deemed necessary by supervisory committee) PResearch (CASS related) Research (CASS related) Research (degree related) Culminating Experience E.g Capstone project, applied project, thesis (masters only – 6 credit hours) Sub-total) Credit Hours	PUP598	_	110	0 1
PAF591 Application BIO545 Introduction to Policy Informatics Populations: Evolutionary Geneticsor equivalent One of the following	CES561			
Populations: Evolutionary Geneticsor equivalent One course in application of CASS approaches. Choose from One of the following ASM591/BIO 591 PAF591 Social Network Analysis Dynamics in Psychology PSY576 Dynamics in Perception, Action, & Cognition Current Issues in Animal Behavior Topics in Mathematics for Life and Sustainability Science Populations: Evolutionary Ecologyor equivalent Elective or Research Courses (as deemed necessary by supervisory committee) (New Course?) Yes or No? Research (CASS related) Research (degree related) Research (degree related) Culminating Experience E.g Capstone project, applied project, thesis (masters only – 6 credit hours) or dissertation (doctoral only – 12 credit hours) as applicable	PAF591			
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One of the following ASM591/BIO 591 PAF591 Social Network Analysis Dynamics in Psychology PSY576 PSY598 ANB502 BIO522 BIO522 BIO522 Elective or Research Courses (as deemed necessary by supervisory committee) Elective or Research Courses (as deemed necessary by supervisory committee) Elective or Research (CASS related) Research (degree related) Research (degree related) Culminating Experience E.g Capstone project, applied project, thesis (masters only – 6 credit hours) or dissertation (doctoral only – 12 credit hours) as applicable		Populations: Evolutionary Genetics		
ASM591/BIO 591 Readings in Complexity Complexity in Public Policy & Management Social Network Analysis Dynamics in Psychology PSY576 PSY598 ANB502 BIO591 BIO522 Dynamics in Animal Behavior Topics in Mathematics for Life and Sustainability Science Populations: Evolutionary Ecologyor equivalent Elective or Research Courses (as deemed necessary by supervisory committee) (Prefix & Number) (Course Title) Research (CASS related) Research (degree related) Culminating Experience E.g Capstone project, applied project, thesis (masters only – 6 credit hours) or dissertation (doctoral only – 12 credit hours) as applicable		or equivalent		
Readings in Complexity Complexity Complexity in Public Policy & Management				
ASM591/BIO 591 Complexity in Public Policy & Management Social Network Analysis SOS598 Dynamics in Perception, Action, & Cognition PSY598 ANB502 BIO591 BIO522 Current Issues in Animal Behavior Topics in Mathematics for Life and Sustainability Science Populations: Evolutionary Ecologyor equivalent Elective or Research Courses (as deemed necessary by supervisory committee) (Prefix & Number) Course Title) Research (CASS related) Research (degree related) Research (degree related) Culminating Experience E.g Capstone project, applied project, thesis (masters only – 6 credit hours) or dissertation (doctoral only – 12 credit hours) as applicable		Readings in Complexity		
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SOS598 PSY576 PSY598 ANB502 BIO591 BIO522 Populations: Evolutionary Ecology or equivalent Course Title Research (CASS related) Research (degree related) Research (degree related) Research Sub-total)	PAF591			
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PSY598 ANB502 BIO591 BIO522 Topics in Mathematics for Life and Sustainability Science Populations: Evolutionary Ecologyor equivalent Elective or Research Courses (as deemed necessary by supervisory committee) (Prefix & Number) (Course Title) Research (CASS related) Research (degree related) Research (degree related) Credit Hours (Insert Section Sub-total) Research (degree related) Culminating Experience E.g Capstone project, applied project, thesis (masters only – 6 credit hours) or dissertation (doctoral only – 12 credit hours) as applicable	PSY576		no	3
ANB502 BIO591 BIO522 Topics in Mathematics for Life and Sustainability Science Populations: Evolutionary Ecologyor equivalent Elective or Research Courses (as deemed necessary by supervisory committee) (Prefix & Number) (Course Title) Research (CASS related) Research (degree related) Research (degree related) Culminating Experience E.g Capstone project, applied project, thesis (masters only – 6 credit hours) or dissertation (doctoral only – 12 credit hours) as applicable	PSY598	Cognition		
Sustainability Science Populations: Evolutionary Ecologyor equivalent Elective or Research Courses (as deemed necessary by supervisory committee) (Prefix & Number) (Course Title) Research (CASS related) Research (degree related) Research (degree related) Credit Hours (Insert Section Sub-total) Research (degree related) Credit Hours Culminating Experience E.g Capstone project, applied project, thesis (masters only – 6 credit hours) or dissertation (doctoral only – 12 credit hours) as applicable	ANB502	Current Issues in Animal Behavior		
Populations: Evolutionary Ecology	BIO591			
Elective or Research Courses (as deemed necessary by supervisory committee) (Prefix & Number) (Course Title) Research (CASS related) Research (degree related) Culminating Experience E.g Capstone project, applied project, thesis (masters only – 6 credit hours) or dissertation (doctoral only – 12 credit hours) as applicable Credit Hours (Insert Section Sub-total) Credit Hours (Insert Section Sub-total)	BIO522	•		
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Culminating Experience E.g Capstone project, applied project, thesis (masters only – 6 credit hours) or dissertation (doctoral only – 12 credit hours) as applicable Credit Hours (Insert Section Sub-total)		Research (CASS related)	no	3
Culminating Experience E.g Capstone project, applied project, thesis (masters only – 6 credit hours) or dissertation (doctoral only – 12 credit hours) as applicable (Insert Section Sub-total)		Research (degree related)	no	9
Doctoral Dissertation 12	E.g Capstone project, applied project, thesis (masters only – 6 credit			`
		Doctoral Dissertation		12
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Other Requirements E.g Internships, clinical requirements, field studies as applicable	Credit Hours (Insert Section Sub-total)
For doctoral programs – as approved by the student's supervisory committee, the program can allow 30 credit hours from a previously awarded master's degree to be used for this program. As applicable, please indicate the total credit hour allowance that will be used for this program.	45-47
Total required credit hours	