CONNECTICUT BOARD OF REGENTS FOR HIGHER EDUCATION
Connecticut State Colleges & Universities
*APPLICATION FOR **NEW PROGRAM APPROVAL***

SECTION 1: GENERAL INFORMATION

Institution: Central Connecticut State University	Date of Submission to CSCU Office of the Provost:
Most Recent NECHE Institutional Accreditation Action and Date: Accredited April 12, 2019	
Program Characteristics Name of Program: Civil Engineering Degree: Title of Award *(e.g. Master of Arts)* Master of Science in Civil Engineering (MSCE) Degree Certificate: *(specify type and level)* Stand-Alone Certificate: *(specify type and level)* Anticipated Program Initiation Date: Fall 2021 Anticipated Date of First Graduation: December 2022 Modality of Program: X On ground Online Combined If "Combined", % of fully online courses? Locality of Program: X On Campus Off Campus Both	**Program Credit Distribution** # Credits in General Education: 0 # Credits in Program Core Courses: 6 # Credits of Electives in the Field: 18 # Credits of Other Electives: 0 # Cr Special Requirements *(include internship, etc.):* 6 Thesis Total # Cr in the Program *(sum of all #Cr above)*: 30 From "Total # Cr in the Program" above, enter #Cr that are part of/belong in an already approved program(s) at the institution: 9 in initial concentration
NOTE: All applications to establish a new program will be considered for both Licensure and Accreditation by the BOR	
CIP Code Number 14.0801 Title of CIP Code Civil Engineering, General	
If establishment of the new program is concurrent with discontinuation of related program(s), please list for each program: Program Discontinued: MS Engineering Technology CIP: 15.0000 OHE#: 009299 BOR Accreditation Date: 10/17/2001 Phase Out Period 3 years Date of Program Termination Spring 2023	
Institution's Unit *(e.g. School of Business)* School of Engineering, Science, and Technology Location *(e.g. main campus)* Offering the Program: CCSU main campus.	
Other Program Accreditation: • If seeking specialized/professional/other accreditation, name of agency and intended year of review: Engineering Accreditation Commission of Accreditation Board for Engineering and Technology (EAC of ABET) 2022-2023 • If program prepares graduates eligibility to state/professional license, please identify: Professional Engineering (PE) licensure in many States requires continuing education credits beyond the BS degree in engineering. The Master of Science in Civil Engineering (MSCE) would typically satisfy these requirements. *(As applicable, the documentation in this request should addresses the standards of the identified accrediting body or licensing agency)*	

Institutional Contact for this Proposal: Peter F. Baumann, Ph.D.	Title: Professor (Former Chair), Engineering Department	Tel.: 860-832-0086 e-mail: baumannp@ccsu.edu

SECTION 2: PROGRAM PLANNING ASSESSMENT

Alignment of Program with Institutional Mission, Role and Scope

(Provide concise statements)

Proposal:

The Engineering Department within the School of Engineering, Science, and Technology at Central Connecticut State University will transition its Master of Science in Engineering Technology (MSET) degree program with two specializations and instead offer two independent Master of Science in Engineering degrees: a Master of Science in Civil Engineering (MSCE) and a Master of Science in Mechanical Engineering (MSME). The MSCE will eventually afford students the option of three concentrations: (1) Structures; (2) Transportation; and (3) Environmental and Water Resources Engineering. The Engineering Department intends to first offer the "Structures" concentration given our current and initially proposed resources. With continued growth, additional faculty members could be added to achieve full-scale program implementation across all three concentrations.

The Mission of Central Connecticut State University:

Central Connecticut State University is a community of learners dedicated to teaching and scholarship that emphasizes development and application of knowledge and ideas through research and outreach activities, and prepares students to be thoughtful, responsible and successful citizens. As a comprehensive public university, we provide broad access to quality degree programs at the baccalaureate, master's, and doctoral levels.

The Mission of the School of Engineering, Science, and Technology (SEST):

*The School of Engineering, Science & Technology will strive to provide an innovative and unique educational experience to every student, **develop the most qualified engineers**, scientists and technologists. The School will maintain academic excellence in a wide variety of traditional disciplines and develop innovative disciplines in emerging fields, creating interdisciplinary educational and research programs, and **building the infrastructure to support the expansion of programs**.*

The School will be a leader in developing cross-disciplinary initiatives that combine and expand the talents of its students and faculty in all disciplines and prepares our graduates for a multidisciplinary world through a flexible and diverse curriculum; and, meets the needs for a well-educated and skilled workforce.

*The School of Engineering, Science, and Technology will provide premier undergraduate and graduate programs in engineering, technology, computing, life and physical sciences, and mathematics. The School will provide a technology-rich, and interdisciplinary learning environment that **offers students a rewarding academic experience through experiential and active learning that embraces the concept of "thinking, learning, and doing."***

*The School will strive to **serve a student population that mirrors the diversity of the region and includes many international students**. The School aspires to be a leading force in offering a number of creative outreach programs designed to encourage and support all students to pursue careers in science and engineering.*

Alignment with SEST's mission:

Developing the Most Qualified Engineers

The Master of Science in Engineering Technology (MSET) was developed prior to CCSU offering any engineering degrees.

Enrollments within the program have steadily declined from 11 students in Fall 2015 to 1 student in Fall 2018. The MSET tends to draw only from the CCSU Bachelor of Science in Engineering Technology programs and a Master's degree is generally not sought by professionals having that credential since it is generally not needed to secure a position. Also, CCSU transitioned its B.S. in Civil Engineering Technology degree into a B.S. in Civil Engineering eliminating the primary source of students for the Civil Specialization of the MSET.

Building the Infrastructure to Support the Expansion of Programs

The MSCE will begin offering a single concentration in Structures. The curriculum is designed to support additional concentrations in Transportation and in Environmental & Water Resources Engineering.

Serving a Student Population That Mirrors the Diversity of the Region and Includes Many International Students

The Master of Science in engineering programs (MSCE and MSME) are more appropriate next steps to our very successful and more analytical engineering degrees now offered. Over the past 3 years, the Civil Engineering BS program averages 113 students in Fall headcount enrollment and graduates an average of 27 students per year. Many of our graduates have needed to seek advanced degrees at other institutions. The MSCE will draw students from a larger number of in-State graduates and professionals holding a BS in Civil Engineering. International students may also find the degree attractive to bolster their credentials for work in the US.

Offering students a rewarding academic experience through experiential and active learning that embraces the concept of "thinking, learning, and doing."

Attracting Masters-level engineering students allows faculty opportunities to undertake more challenging research including industrial community outreach through company-sponsored projects. The two-term Thesis requirement provides the curricular opportunity for graduate students to perform such research in consultation with their faculty advisor.

Consistent with CCSU's mission, the proposed MSCE provides educational advancement through learning-centered environments designed to engage students and faculty in the discovery, application, and dissemination of knowledge. Advancing students' knowledge base and professional achievements transform students from generalists to specialists in their respective fields. Our curricular experiences and pedagogy are centered around finding solutions to technological, human, and environmental challenges that improve the quality of life.

Addressing Identified Needs

- How does the program address CT workforce needs and/or the wellbeing of CT communities – and include a description/analysis of employment prospects for graduates of this proposed program *(Succinctly present as much factual evidence and evaluation of stated needs as possible)*

We expect our MS graduates to help fill the state-wide demand for civil engineers and take on jobs requiring advanced abilities and responsibility.

State of Connecticut market feasibility – *The State of Connecticut Occupational Projections: 2016-2026* reported that employment of civil engineers is solid and is projected to grow over the next decade. The State of Connecticut employment projections are shown in

Table 1 and these include the need for professionals with MS degrees. Although the minimum education is a Bachelor's

degree, the need for professionals with MS degrees should grow at comparable rates.

Table 1: State of Connecticut Occupational Projections: 2016-2026

Occupational Title	Estimated Employment 2016	Projected Employment 2026	10 Year Net Change	10 Year Percent Change	Annual Growth Openings	Annual Total Openings	Median Annual Wage	Minimum Education
Civil Engineers	3,441	3,776	335	9.7	34	290	$90,915	Bachelor's degree
https://www1.ctdol.state.ct.us/lmi/projections2016.asp								

According to JobsEQ Connecticut added 182 jobs in civil engineering over the past 3 years since Q3 of 2019. Over the last 180 days from January 30, 2020, Jobs EQ reported 199 job postings in Connecticut for occupations related to civil engineering. Further, there were 58 postings for transportation engineers, a planned concentration. Jobs EQ projects that approximately 61.5% of currently employed civil engineers in Connecticut do not have an advanced degree. **T**he State of Connecticut tends to import civil engineers, reflecting a need for a more highly trained workforce.

National market feasibility – The federal Employment Projections program in the U.S. Department of Labor's Bureau of Labor Statistics provides the national data on civil and mechanical engineering disciplines employment and forecasts for future hiring needs. As shown in Table 2, these projections include growth and replacement openings. Growth is expected to be 10.6% in civil engineering. According to the DOL data, earnings are also expected to remain very strong.

Table 2: National occupational employment and job openings data, projected 2016 and projected 2026, and worker characteristics, 2016 (Numbers in thousands)

Occupational Title	Employment		Employment Change, 2016-26		Average annual job openings due to growth and replacements, 2016-26	Typical education needed for entry
	2016	2026	Number	Percent		
Civil Engineers	303.5	335.7	32.2	10.6	25.9	BS
https://projectionscentral.com/Projections/LongTerm						

- How does the program make use of the strengths of the institution (*e.g. curriculum, faculty, resources)* and of its distinctive character and/or location?

Institutional Strength – CCSU's academic infrastructure emphasizes science, engineering, and technology. CCSU is the only university in the CSCU system that offers baccalaureate engineering degrees. All full-time tenured or tenure-track faculty members in the Engineering Department earned an engineering doctorate which is required for teaching at the graduate level.

Our new planned engineering building slated for opening in Fall 2021 will provide additional needed laboratory space and equipment for research (described below).

Location – CCSU's location in the center of Connecticut and near two urban areas (New Britain and Hartford) provides the opportunity for broad access across the state. Also, we intend to offer both day and evening courses to be mindful of both traditional full-time students as well as industry professionals seeking advanced credentials. The fact that many companies reimburse employees' graduate study makes it plausible for students employed in local industry to take advantage of this financial incentive to take evening classes. In addition, many of the envisioned research projects will involve faculty and students collaborating side-by-side with local industry, which in turn paves the way for funding through contracts and grants

from industry.

- Equity (eliminating achievement disparities among different ethnic/racial, economic and gender groups) is one of the Board of Regents' Goals. In addition to current institutional efforts already underway, what distinct actions will the proposed program undertake to advance equitable student success?

In accordance with the Mission of The School of Engineering, Science, and Technology, the School will strive to serve a student population that mirrors the diversity of the region and includes many international students. The School aspires to be a leading force in offering a number of creative outreach programs designed to encourage and support all students to pursue careers in science and engineering. There are also efforts to provide broader access and greater flexibility to students with families. The planned drop-in center for child-care may be a game changer particularly for women in STEM. There may also be opportunity to offer graduate assistantships to support students from historically underrepresented populations. The program will allow all enrolled students to pursue more focused engineering study which will enable program graduates greater potential to succeed in their careers as problem solvers, designers, communicators, professionals, experimenters, and life-long learners.

- Describe any transfer agreements with other CSCU institutions that will be instituted as a result of the approval of this program *(Please highlight details in the Quality Assessment portion of this application, as appropriate)*

None.

- Indicate what similar programs exist in other CSCU institutions, and how unnecessary duplication is being avoided

No similar program exists at other CSCU institutions.

Cost Effectiveness and Availability of Adequate Resources

(Complete the PRO FORMA Budget – Resources and Expenditure Projections on page 6 and provide a narrative below regarding the cost effectiveness and availability of adequate resources for the proposed program. Add any annotations for the budget form below, as well.)

[i]Projected enrollments built in attrition at the rate of 1 full-time student each Spring semester.

[ii]Tuition revenue was conservatively estimated with AY 2019-20 in-state graduate rates. For full-time graduate students, tuition was $3,689 per term plus the University General Fee less accident insurance ($1908). We assumed that PT students would take six credits per semester, resulting in $4,181 of revenue per student ($407 tuition per credit, $279 general fee per credit, and $65 registration fee). No tuition increases for 2021-23 were built into the budget.

[iii]The program will pursue instituting a program fee every semester of $250 for full-time students and $125 for part-time students.

[iv]A program coordinator from the full-time faculty will receive three credits of reassigned time per semester for coordinating the program. Replacement costs for a part-time faculty member to meet instructional demand at the undergraduate level was estimated to be $13,142 per academic year (AY 2019-20 Group B lecturer rate $1,672 x 6 credits x 1.31 fringe).

[v]Instructional costs scale with the number of credits expected to be offered, with the assumption that ENGR 501 and ENGR 592 would be offered every semester. We anticipate 27 credits offered in Year 1. Starting in Year 2, we expect to offer 36 credits per academic year. We estimated FT salary using the median FY20 salary of current faculty teaching with the program

and 73.28% fringe. .In Year 1, two core courses (ENGR 501, ENGR 592) and one elective (ENGR 557) will combine MSME students with MS Civil Engineering students. Consequently, the true instructional estimates for Year 1 are scaled: 15 credits of instructional cost at 40% and 12 credits of instructional cost at 100%.

[vi]An administrative professional is anticipated to spend approximately 5% of their time in direct support of the MS in Civil Engineering. With 73.28% fringe and a 3% COLA added each year, expected expenses range from $5,614 to $5,956. In addition, a computer technician is expected to support the program approximately 5% of the time. With benefits, anticipated expenses range from $6,678 to $7,085. Further, the Engineering Department would hire one Graduate Assistant to support the program and report to the Program Coordinator. Total stipend was projected at $4,800 per academic year.

[vii]Additional books on design, materials, and structural engineering may be needed. Given that the Library resources already support our robust undergraduate program, additional requests for the MS program would occur through the Library's typical requisition process and would not require additional funds to support.

[viii]Replacement costs for non-capital equipment are covered by the program fees collected as revenue less the stipen for the graduate assistant.

[ix]Other costs include a 3-year marketing plan of approximately $5,000 in Year 1, $2,500 in Year 2, and $2,500 in Year 3. As this marketing plan involves a joint venture with the MS in Mechanical Engineering, some savings were built into these estimates. Further additional costs included an incremental increase in the demand for software licenses (described below). Although CCSU already supports all of the anticipated software for this program, there could be incremental increases due to increased enrollment. We estimated $100 in incremental increased expense per FTE resulting in projected expenses of $1,000 in Year 1, $1,800 in Year 2, and $2,000 in Year 3.

Student Recruitment / Student Engagement

What are the sources for the program's projected enrollments. Describe the marketing, advisement and other student recruitment activities to be undertaken to ensure the projected enrollments are achieved. If applicable, what student engagement strategies will be employed to advance student retention and completion in program?

Projected Enrollments –

Part of our enrollment will come from students in our undergraduate program progressing directly to the graduate degree. Degree conferrals over the past 5 years for the BS in Civil Engineering are:

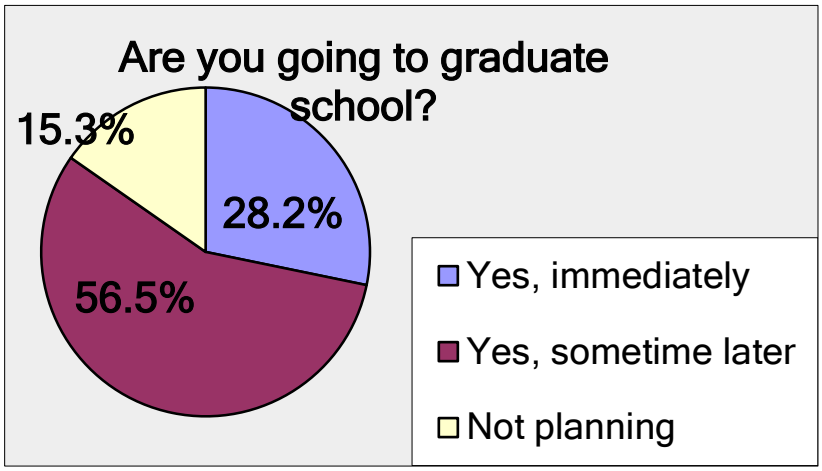
2014-15	2015-16	2016-17	2017-18	2018-19
17	20	20	22	27

Analysis of the exit interview data below for our B.S. graduates shows that the majority are either pursuing a master's degree immediately after graduation or in the near future:

CCSU – FA 13 - FA 16 ME Program Exit Interview Questionnaire

Are you going to graduate school?	

Answer Options	Response Percent	Response Count
Yes, immediately	28.2%	24
Yes, sometime later	56.5%	48
Not planning	15.3%	13
answered question		85



Approximately 42% of our undergraduates would qualify for admission to the graduate program. If we take the cumulative number of CCSU BSCE graduates over the past 5 years (106) and—to be conservative—the percentage of those who desire to pursue an MS immediately (28.2%), and the fraction that would qualify for admission (106 x 0.282 x 0.42), we could expect 13 former students from CCSU to be amongst the first to enroll in the program. Given that CCSU would be one of only four institutions in the state to offer an MS in Civil Engineering, we could reasonably expect two recent graduates from Quinnipiac, University of Connecticut, University of Hartford, or University of New Haven to pursue the MSCE. CCSU's program would provide a high-quality, cost-effective alternative to existing programs in the state.

The following table contains IPEDS data for degree completions across other schools in CT that offer BS and/or MS programs in Civil Engineering.

BS Civil Engineering

Institution	AY 2013-2014	AY 2014-15	AY 2015-16	AY 2017-18	AY 2018-19
Quinnipiac University	0	0	1	5	7
United States Coast Guard Academy	39	29	36	25	21
University of Connecticut	60	65	75	100	75
University of Hartford	18	25	27	24	48
University of New Haven	11	19	21	19	11

MS Civil Engineering

Institution	AY 2013-2014	AY 2014-15	AY 2015-16	AY 2017-18	AY 2018-19
Quinnipiac University	n/a	n/a	n/a	n/a	n/a
United States Coast Guard Academy	n/a	n/a	n/a	n/a	n/a
University of Connecticut	14	19	17	16	12
University of Hartford	10	14	25	13	7
University of New Haven	n/a	n/a	n/a	0	0

This degree can also attract students from across New England and internationally.

Marketing, Advisement and other Student Recruitment Activities – In an effort to secure projected enrollment for this program, the Department, assisted by the School and University, will embark on a 3-year multifaceted marketing, advisement, and recruitment strategy. Funds to support these activities are designated on the budget.

Within the Department, program coordinators will gather lists of bachelor's program alumni and graduating seniors which would meet the admission requirements for direct e-mail contact. The local professional organizations in the engineering fields (ASCE) will also be contacted as a vehicle for communication of advertising materials.

We hope to also highlight our new program though our University's standard advertising. With the help of our University's Office of Marketing and Communication, the MSCE Program will be presented through:

1) Press Release
2) Advertisements
3) Mailers (Brochures), E-mail
4) Website Updates and Redesign
5) Social Professional Media (Linked-in)
6) Engineering Company Contacts
7) International Agents / Exchange Programs

Whenever possible, we will facilitate communication though our faculty to maximize the appeal. With the help of our University's Graduate School Office, through some of the above listed means, we hope to also secure superior turnout of participants interested in Engineering at the Graduate Open House events.

CCSU also plans to develop several digital marketing campaigns including ads on social media, Google, and graduate recruitment sites such as Gradschools.com and Petersons.com. CCSU's digital campaigns will periodically be supported by print campaigns on local billboards, mass transit, and newspapers as well as radio campaigns targeting specific recruitment events.

SECTION 3: PROGRAM QUALITY ASSESSMENT

Learning Outcomes - L.O. *(Please list up to seven of the most important student learning outcomes for the program and concisely describe assessment methodologies to be used in measuring the outcomes. If the program will seek external accreditation or qualifies graduates to opt for a professional/occupational license, please frame outcomes in attention to such requirements. With as much detail as possible, please map these learning outcomes to courses listed under the "Curriculum" section of this application)*

The Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (EAC of ABET) requires MS graduates to show the same learning outcomes as BS recipients for accreditation. To distinguish the undergraduate from the graduate outcomes, we would expect that graduates with an MS degree to show "increased" ability in all ABET outcomes. The MSCE has the following learning outcomes in fulfillment of ABET expectations:

1. Increased ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. Increased ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. Increased ability to communicate effectively with a range of audiences.
4. Increased ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. Increased ability to function effectively, with faculty advising committee guidance, to establish goals, plan tasks, and meet objectives.
6. Increased ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. Increased ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Capstone thesis rubrics will measure the outcomes.

Program Administration *(Describe qualifications and assigned FTE load of administrator/faculty member responsible for the day-to-day operations of the proposed academic program. Identify individual for this role by name or provide time frame for prospective hiring)*

The Chair of the Engineering Department (Dr. Nidal Al-Masoud) would have overall responsibility for Program Administration assisted by a dynamic MSCE Program Coordinator needing up to 3 reassigned load credits per semester to be responsible for the day-to-day operations of the new proposed academic program. Dr. Young Moo Sohn is recommended for this role.

Faculty *(Please complete the faculty template provided below to include current full-time members of the faculty who will be teaching in this program and, as applicable, any anticipated new positions/hires during the first three years of the program and their qualifications)*

How many new full-time faculty members, if any, will need to be hired for this program?

The program will require two new full-time faculty members for initial implementation: one in Year 1 and a second in Year 2 or 3. As the program is modified with additional concentrations, faculty will be added accordingly.

What percentage of the credits in the program will they teach?

New faculty will teach 20% of this new program and will be assigned courses in the baccalaureate program normally covered by more senior faculty eager to teach at the graduate level.

What percent of credits in the program will be taught by adjunct faculty?

0%

Describe the minimal qualifications of adjunct faculty, if any, who will teach in the program

Minimum qualifications will be consistent with the requirements of our Graduate School (i.e., an Engineering Doctorate in Civil Engineering or a closely related field).

Special Resources *(Provide a brief description of resources that would be needed specifically for this program and how they will be used, e.g. laboratory equipment, specialized library collections, etc. Please include these resources in the Resources and Expenditures Projections spreadsheet)*

This program will utilize laboratories and equipment within the new engineering building at CCSU, in addition to existing and renovated facilities in Copernicus. In the new engineering building, the following civil engineering and general engineering laboratories will be available for use by the MSCE program: Computation Space, Concrete Lab, Engineering Materials Lab, Materials Science Lab, Engineering Mechanics Lab, Structures Lab, Fluids and Thermal Science Lab, Survey & Transportation Lab, and Civil Design Lab. Capital lab equipment is partially bonded through the building project. Maintenance of equipment including repair, service contracts, and calibration is required. The proposed program fees will offset such costs.

CCSU already supports the software needs of the Engineering programs. Program faculty anticipate using the following software: MATLAB, MAPLE, Mathematica, MiniTab, Ansys, Siemens NX, Solid Works, National Instruments LabView, PCT, BIOWin, Autodesk (free), Livermore LSDYNA, CSI SAP2000, Bentley, CNC Software Mastercam, CGTech Vericut, and IBM SPSS. Because increased enrollment could produce increased need for licenses, we estimated the additional incremental expense of each FTE student in the MSCE at $100 per year.

Curriculum

*(Please list courses for the proposed program, including the core/major area of specialization, prerequisites, electives, required general education courses (undergraduate programs), etc. Using numerals, map the Learning Outcomes listed in the previous section to relevant program courses in this table. Mark any new courses with an asterisk * and attach course descriptions. Mark any courses that are delivered fully online with a double asterisk ** Please modify this format as needed)*

Course Number and Name	L.O. # [1]	Pre-Requisite	Cr Hrs	Course Number and Name	L.O. #	Cr Hrs
Program Core Courses				**Other Related/Special Requirements***		
ENGR 501 – Engineering Analysis*	1	MSCE Admission	3			
ENGR 592 – Methods of Engineering Research	6	MSCE Admission	3			
CE 597 – Civil Engineering Thesis I*	4	ENGR 592	3			

[1] From the Learning Outcomes enumerated list provided at the beginning of Section 3 of this application

CE 599 – Civil Engineering Thesis II*	1-7	CE 597	3			
Core Course Prerequisites				**Elective Courses in a Concentration** (18 Cr. in a Concentration Area)		
ENGR 592 – Methods of Engineering Research			3	*Structures (18 Cr.)*		
CE 597 – Civil Engineering Thesis I			3	ENGR 557 – Advanced Mechanics of Materials*	1, 2	3
				CE 552 – Advanced Foundation Engineering*	1, 2	3
				CE 570 – Advanced Steel Structure Design*	1, 2	3
				CE 571 – Advanced Concrete Design*	1, 2	3
				CE 572 – Design of Prestressed Concrete Structures*	1, 2	3
				CE 573 – Plastic Design of Steel Structures*	1, 2	3
				CE 574 – Finite Element Methods for CE Structures*	1, 2	3
				CE 575 – Dynamics of Structures*	1, 2	3
				CE 576 – Bridge Engineering*	1, 2	3
				CE 577 – Earthquake Engineering*	1, 2	3
				CE 578 – Loads for Civil Structures*	1, 2	3
Total Other Credits Required to Issue Credential *(e.g. GenEd/Liberal Arts Core/Liberal Ed Program)*						

***Special Requirements** include co-curriculum activities – structured learning activities that complement the formal curriculum – such as internships, innovation activities and community involvement.
None.

Program Outline *(Please provide a summary of program requirements including total number of credits for the degree, special admission requirements, capstone or special project requirements, etc. Indicate any requirements and arrangements for clinical affiliations, internships, and practical or work experience.)*

This program at Central Connecticut State University will require all applicants to have the equivalent of a BS in Civil Engineering with a minimum 3.0/4.0 cumulative GPA per detailed and documented Admission Standards.

Graduation with an MSCE diploma requires completion of 30 credit hours including a six-credit, two-course thesis capstone sequence.

Academic Map for Master of Science in Civil Engineering:

Year 1 **Fall Semester**	**Year 1** **Spring Semester**	**Year 2** **Fall Semester**
ENGR 501 – Engineering Analysis	CE 597 – Civil Engineering Thesis I	CE 599 – Civil Engineering Thesis II

ENGR 592 – Methods of Engineering Research	Elective Course	Elective Course
Elective Course	Elective Course	Elective Course
Elective Course		

Course Descriptions of New Courses

ENGR 501: Engineering Analysis. Applications of mathematical analysis and numerical concepts to typical engineering problems such as analytical and numerical solutions for linear and nonlinear ordinary differential equations, Fourier series and integrals, the Laplace transform, and the solution of partial differential equations. Examples used in the course will be derived from the field of engineering. Use of computational software tools is an integral part of this course.

ENGR 557: Advanced Mechanics of Materials. This course explores advanced topics in mechanics of materials. Subjects include plasticity, orthotropic materials, energy methods, torsion of non-circular shafts, shear center, and beams on elastic foundations.

ENGR 592: Research and Development of Experiments. Concepts and procedures for obtaining, evaluating, and reporting existing and measured data.

CE 552: Advanced Foundation Engineering. A study of the methods for subsoil investigations and in-situ testing to determine soil characteristics, analysis and design of shallow and deep foundations, and gravity and cantilever retaining walls.

CE 570: Advanced Steel Structure Design. The objective of this course is to develop an understanding of behavior and design methodology for the structural steel topics of column design and behavior considering residual stresses, lateral torsional buckling of beams, beams with web holes, torsional design of beams, composite design of beams, plate buckling & plate girders, bracing requirements for compression members, and frame stability.

CE 571: Advanced Concrete Design. The objective of this course is to learn advanced topics related to the behavior and design of reinforced concrete. Topics include flexural behavior of reinforced concrete, the behavior and design of slender columns and two-way slab systems, and the use of strut and tie modeling for design of structural components, frame joints, and torsion.

CE 572: Design of Prestressed Concrete Structures. This course is intended to provide the student with the basic tools required to design and build prestressed concrete structures. Emphasis will be placed on the behavior of prestressed concrete under load along with potential failure mechanisms.

CE 573: Plastic Design of Steel Structures. The objective of this course is to understand the behavior of steel structures beyond the elastic limit and up to the point of collapse. This course extends the student's knowledge and understanding of the theory of steel structures to include plastic behavior and collapse mechanisms.

CE 574: Finite Element Method for CE Structures. This course is an introduction to FEM as applied to elasticity problems in solid and structural mechanics. The mathematical equations are developed using the virtual work basis of FEM and this is used to develop equations for one, two- and three-dimensional elements. As FEM is a computational tool this course includes practical exercises using the commercial package. A number of tutorials involving hand calculations are provided to aid understanding of the technique.

CE 575: Dynamics of Structures. Structures are often subjected to dynamic forces of one form or the other during their lifetime. This course introduces the theory of dynamic response of structures. This course includes free and forced vibration response of single and multi-degree of freedom systems to learn the fundamentals of modeling and analyzing dynamic behavior of civil engineering structure.

CE 576: Bridge Engineering. The objective of this course is to understand general considerations for design and load capacity evaluation of highway bridges. Topics of this course are introduction to load and resistance factor design (LRFD) philosophy, bridge loads, Influence lines, and introduction to seismic analysis and design.

CE 577: Earthquake Engineering. The objective of this course is to give students an overview of both the theory and the practice of earthquake engineering. The course deals with aspects of engineering seismology and earthquake structural engineering. Topics covered in the course include ground motion characterization, response spectra, and inelastic structural analysis.

CE 578: Loads for Civil Structures. Covers the computation of loads on buildings and other civil structures using the International Building Code (IBC) and ASCE 7, Minimum Design Loads for Buildings and Other Structures. The loads presented will include gravity loading analysis, occupancy loads, vehicle loads, roof live, wind, ice, and ponding loads, flood and tsunami loads, and wind loads. Lateral seismic loading of buildings will be introduced. Free standing structure loading and probable combinations of loads will be covered.

CE 597: Thesis I. Initiation of the thesis creation process, under guidance of a thesis advisor, for students working towards fulfilling the requirements for the degree of Master's of Science in Civil Engineering.

CE 599: Thesis II. Completion of the thesis creation process, under guidance of a thesis advisor, for students working towards fulfilling the requirements for the degree of Master's of Science in Civil Engineering.

NOTE: The PRO FORMA Budget on the last page should provide reasonable assurance that the proposed program can be established and is sustainable. Some assumptions and/or formulaic methodology may be used and annotated in the "Cost Effectiveness …" narrative on page 5.

Full-Time Faculty Teaching in this Program *(Note: If you anticipate hiring new faculty members for this program you may list "to be hired" under name and title. Provide required credentials, experience, and other responsibilities for each new position anticipated over the first three years of implementation of the program)*

Faculty Name and Title	Institution of Highest Degree	Area of Specialization/Pertinent Experience	Other Administrative or Teaching Responsibilities
Dr. Nidal A. Al-Masoud, Professor & Chair	University of Buffalo, Ph.D., 2002	Mechanical Engineering/ 19 yrs. teaching, 13 yrs. professional practice	Engineering Department Chair
Dr. Luz Amaya, Assoc. Professor	City University of New York, Ph.D., 2010	Mechanical Engineering/ 9 yrs. teaching, 3 yrs. professional practice	Coordinator BS Mechanical Engineering
Dr. Clifford Anderson, Assoc. Professor	University of New Mexico, Ph.D., 2004	Civil Engineering/ 14 yrs. teaching, 30 yrs. professional practice	
Dr. Swamy Basim, Assoc. Professor	New Jersey Institute of Technology, Ph.D., 1999	Civil Engineering/ 29 yrs. teaching, 12 yrs. professional practice	Coordinator BS Civil Engineering
Dr. Peter F. Baumann, Professor (Former Chair)	NYU Polytechnic School of Engineering, Ph.D., 1997	Materials Engineering/ 18 yrs. teaching, 20 yrs. professional practice	
Dr. Young M. Sohn, Asst. Professor	Purdue University, Ph.D., 2012	Structural Engineering/ 6 yrs. teaching, 5 yrs. professional practice	Planned Coordinator MS Civil Engineering
Dr. Bin (Brenda) Zhou, Assoc. Professor	The University of Texas at Austin, Ph.D., 2009	Civil Engineering/ 11 yrs. teaching, 1 yr. professional practice	
To be hired, Asst./Assoc. Professor		Civil Engineering/ Minimum 2 yrs. professional practice (Replacement for current vacancy)	
To be hired, Asst./Assoc. Professor (NEW)		Civil Engineering/ Minimum 2 yrs. professional practice (For MSCE)	
To be hired, Asst./Assoc. Professor (NEW)		Civil Engineering/ Minimum 2 yrs. professional practice (For MSCE)	

Chart Area

CONNECTICUT BOARD OF REGENTS FOR HIGHER EDUCATION
Connecticut State Colleges & Universities
*APPLICATION FOR **NEW PROGRAM APPROVAL***
PRO FORMA Budget - Resources and Expenditures Projections (whole dollars only)

PROJECTED Enrollment[i]	2021-22						2022-23						2023-24					
	Fall Semester		Spring Semester		Summer		Fall Semester		Spring Semester		Summer		Fall Semester		Spring Semester		Summer	
	FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	FT	PT
Internal Transfer (from other programs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New Students (first time matriculating)	7	6	3	3	0	0	7	6	3	3	0	0	7	6	3	3	0	0
Continuing Students progressing to credential	0	0	6	6	0	0	9	9	9	15	0	0	9	18	9	18	0	0
Headcount Enrollment	7	6	9	9	0	0	16	15	12	18	0	0	16	24	12	21	0	0
Total Estimated FTE per Year[1]	**9.8**						**17.3**						**19.3**					
PROJECTED Program Revenue	2021-22						2022-23						2023-24					
	Fall Semester		Spring Semester		Summer		Fall Semester		Spring Semester		Summer		Fall Semester		Spring Semester		Summer	
	FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	FT	PT
Tuition[2].[ii]	$39,179	$25,086	$50,373	$37,629	$0	$0	$89,552	$62,715	$67,164	$75,258	$0	$0	$89,552	$100,344	$67,164	$87,801	$0	$0
Tuition from Internal Transfer[2]	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Program Specific Fees (lab fees, etc.)[iii]	$1,750	$900	$2,250	$1,350	$0	$0	$4,000	$2,250	$3,000	$2,700	$0	$0	$4,000	$3,600	$3,000	$3,150	$0	$0
Other Revenue (annotate in narrative)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Annual Program Revenue	**$158,517**						**$306,639**						**$358,611**					

PROJECTED Program Expenditures[3]	2021-22	2022-23	2023-24
Administration (Chair or Coordinator)[4].[iv]	$13,142	$13,142	$13,142
Faculty (Full-time, total for program)[4].[v]	$103,241	$252,367	$252,367
Faculty (Part-time, total for program)[4]	$0	$0	$0
Support Staff (lab or grad assist, tutor)[vi]	$17,092	$17,461	$17,840
Library Resources Program[vii]	$0	$0	$0
Equipment (List in narrative)[viii]	$1,450	$7,150	$18,550
Other[ix]	$6,000	$4,300	$4,500
Estimated Indirect Costs[6]			
Total Expenditures per Year	**$140,925**	**$294,419**	**$306,399**

NOTE: Existing regulations require that: "an application for a new program shall include a complete and realistic plan for implementing and financing the proposed program during the first cycle of operation, based on projected enrollment levels; the nature and extent of instructional services required; the availability of existing resources to support the program; additional resource requirements; and projected sources of funding. If resources to operate a program are to be provided totally or in part through reallocation of existing resources, the institution shall identify the resources to be employed and explain how existing programs will be affected. Reallocation of resources to meet new and changing needs is encouraged, provided such reallocation does not reduce the quality of continuing programs below acceptable levels."

1 1 FTE = 15 credit hours for undergraduate programs; 1 FTE = 12 credit hours for graduate programs; both for Fall & Spring

Formula for conversion of part-time enrollments to Full-Time Equivalent (FTE): Divide part-time enrollment by 3, and round to the nearest tenth - for example 20 part-time enrollees equals 20 divided by 3 equals 6.67 or 6.7 FTE.

2 Revenues from all courses students will be taking.

3 Capital outlay costs, instructional spending for research and services, etc. can be excluded.

4 If full-time person is solely hired for this program, use rate time; otherwise, use a percentage. Indicate if new hires or existing faculty/staff. Record Salary and Fringe Benefits, accordingly.

5 e.g. student services. Course development would be direct payment or release time; marketing is cost of marketing that program separately.

6 Check with your Business Office – community colleges have one rate; the others each have their own. Indirect Cost might include such expenses as student services, operations and maintenance.