SPRINGFIELD TECHNICAL COMMUNITY COLLEGE

ACADEMIC AFFAIRS

Course Number: EGR-101 Class/Lect. Hours: 3 Lab Hours: ____ Credits: 3 Dept.: Engineering Transfer

Course Title: The Creative Art of Structures Semester: Spring Year: 2016

Course Description, Prerequisite, Corequisite: Learn how to interpret and understand the built environment through technical, visual, and social analysis and critique of bridges, tall buildings, and structural designers. *The Creative Art of Structures* is a modern history of structural engineering through the lens of excellence in design. In a survey of some of the world's most iconic structures—towers, tall buildings, bridges, and thin concrete shells—structural engineering will be presented as an art form rather than just a technical endeavor. Innovative structures will be studied from engineering, architectural, cultural, and social perspectives. Structural engineers including bridge engineers Eiffel, Roebling, Robert Maillart, Christian Menn, and Othmar Ammann will be featured, as will tall building engineer Fazlur Khan and thin shell designers Dieste, Candela, and Isler. Open to all students in any major—no engineering background is necessary. Pre-requisites: MAT-097 (minimum grade of C) or placement at college level Math.

Course Objectives	Competencies
For structures covered in the course: 1. Identify a structure's designer and location from an image.	▪ Understand different types of structures—bridges, towers, tall buildings, and thin shells, etc. ▪ Develop knowledge of innovative and historic structures around the world. ▪ Understand the history of engineering and the engineer in history. Understand difference between engineer and architect and "engineering art" and "architectural art" in the context of structural design. ▪ Develop knowledge of important structural engineers and designers.
2. Explain how form relates to forces in the structure.	▪ Understand types of forces (loads) on structures.

Course Objectives	Competencies
	▪ Understand "how structures are strong" or respond to loads: tension, compression, shear, bending, and torsion. ▪ Understand structural forms. ▪ Understand the development and uses of structural materials—steel and reinforced concrete in particular—and their material properties. ▪ Explore conecpts of strength, stiffness, and stability.
3. Explain the social, symbolic, and scientific significance of the structure (GWB, Eiffel Tower, Hancock, and Salginatobel Bridge, etc.).	▪ Explore the concept of engineering design and design excellence. ▪ Understand the language of structures and the concept of structural art. ▪ Define and understand social, symbolic, and scientific significance. ▪ Define and understand efficiency, economy, and elegance of structures. ▪ Understand the impact of engineering design on society and the ways in which structures are modern monuments to cultures, corporations, economies, technology, and nations. ▪ Understand the technical aspects of engineering design. ▪ Understand development and innovation with respect to new materials and technologies in meeting design goals and challenges.
4. Explain qualitatively how the loads are transferred by the structural system to the ground.	▪ Understand how structures respond to loads: tension, compression, bending, shear, and torsion. ▪ Explore structural systems including those of bridges—beam, truss, suspension, and cable-stayed—towers, and tall buildings. ▪ Identify and understand load paths (i.e., "read a structure"). ▪ Understand and draw a free-body diagram.

Course Objectives	Competencies
5. Perform simple calculations to determine the forces in the main structural members.	▪ Develop simple structural models using modeling software. ▪ Perform simple unit conversions; check for dimensional consistency. ▪ Understand and apply simple formulae. ▪ Identify and manipulate quantities/variables such as force, stress, and strain. ▪ Understand and apply material mechanical properties of materials. ▪ Perform calculations to determine tensile, compressive, and bending forces in structural members; factors of safety; strength and deformation. ▪ Report results with accuracy and in conventional formats.
For structures which encountered in the world: 1. Explain qualitatively the means by which loads are transferred to the ground.	▪ Explore structural systems including those of bridges—beam, truss, suspension, and cable-stayed—towers, and tall buildings. ▪ Identify and understand load paths (i.e., "read a structure"). ▪ Understand and draw a proper free-body diagram.
2. Evaluate the qualifications of the structure as a work of structural art.	▪ Explore the ways in which structural aesthestics are measured. ▪ Research and understand authentic structural drawings and technical reports for local structure. ▪ Understand criteria for works of structural art: economy, efficiency, and elegance and social, symbolic, and scientific impact and apply to analyses and critiques.
3. Research the social, symbolic and scientific aspects of the structure and express your findings clearly in both written, graphical, and spoken form.	▪ Perform research using scholarly, technical, and professional sources and databases. ▪ For historic, important, and/or local structures, apply

understanding of social, symbolic, and scientific criteria for structural art in critique of structures.

CRITICAL THINKING:
Evaluation of structures as art
Broadened perspectives of engineering as a creative process
Study of historic developments in structural materials and design
Analysis of significant and/or historic structures in context of design excellence
Exploration the societal impact and significance of structures
Analyses/critiques of local structures
Development of understanding of engineering as a profession that serves and impacts humanity
Awareness of factors involved in engineering design and decisions
Development of engineering (or scientific/technological) "literacy"

WRITTEN/ORAL COMMUNCIATION:
Journal entries
"one-minute" papers (in-class writing exercises)
Design critiques
Peer editing
Essay-style written homework
Research paper
Project presentation

QUANTITATIVE REASONING:
Simple mathematical analysis of forces
Computer modeling of simple structures
"reading" a structure—load path
Predictions and analysis for hands-on demos and activities
Graphical analysis of results

COMPUTER LITERACY:

Course Objectives	Competencies
	Presentation tools/technology Computer modeling Management of information and resources Written analysis/reporting using technical applications and formatting INFORMATION LITERACY: Use of technical/professional databases and authentic resources, including assigned readings Readings/articles Case studies Research and analysis