# SCHOOL OF STEM SYLLABUS

**TERM:**

**INSTRUCTOR:**

**COURSE CODE:** CNM-201

**OFFICE HOURS:**

**COURSE TITLE:** Introduction to Basic Structures

**OFFICE LOCATION:**

**DAY(S) AND TIME(S):**

**EMAIL:**

**LOCATION:**

**PHONE:**

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**COURSE PREREQUISITE:** None

**CREDITS:** 3

**COURSE DESCRIPTION:**

This course provides students with a basic knowledge of structural analysis and design for buildings, bridges and other structures. Students investigate the behavior of structural systems and elements through design exercises, case studies, and load testing of models. Students design structures using timber, masonry, steel, and concrete and gain an appreciation of structural design, with an emphasis on environmental impact associated with large scale construction.

**STUDENT LEARNING OUTCOMES:**

*Upon successful completion of this course, students will be able to*:

- Evaluate quality and types of engineered structures.
- Apply design principles to engineered structures.
- Illustrate free body diagrams that accurately identify internal and external forces of structural members.
- Select appropriate sizes of simple steel and reinforced concrete members for a structure.
- Read structural drawings with accuracy

**TEXTBOOK AND SUPPLEMENTAL MATERIALS:**

1. Proposed student texts.

   i. Design of Reinforced Concrete (9th ed.)
   Jack C. McCormac, Russell H. Brown
   ISBN: 978-1-118-12984-5
   ISBN: 978-1-118-43081-1 (BRV)

**ii.** Steel Construction Manual, Allowable Stress Design, American Institute of Steel Construction.
ISBN: 1-56424-000-2

2. Supplementary readings for students.
Online Courses
SunCam, Inc.
https://www.suncam.com

3. Audiovisual materials and computer software.
Excel Design Worksheet

**GRADING POLICY:**

**SAMPLE COURSE SCHEDULE:**

| **Schedule*** (*Two sessions/week of instruction, or 30 total sessions during a semester) | **Lecture Topic** | **Student Learning Outcomes (SLO)** |
|---|---|---|
| Session 1 | Orientation, description of the course content, purpose, and schedule. Introduction to fundamentals of structures. Potential lecture topics include: definition and brief history of steel structures, reinforced concrete structures, and wood structures.<br><br>Overview of **Types of Structures:** Buildings, bridges, retaining walls, dams, tunnels, tension structures, columns and towers, rigid frames, plane structures, spatial structures, load bearing structures. **Types of Structural Members**: Roofs / floors / slabs, beams, columns, foundations, arches, trusses, walls | SLO 1 |

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| Session 2 | **STATICS** Introduction and definition, study of fundamentals of statics; stress, strain, deformation, shear and bending moment stresses in beams and column.<br><br>Discussion regarding system of units.<br><br>Basic knowledge of Trigonometry.<br><br>Basic knowledge of Geometry.<br><br>Study moments and concept of loads and forces on structural members; apply concept to determining resultant force.<br><br>Parallelogram method<br><br>Triangular rule<br><br>Cosine Law and Sine Law<br><br>Rectangular Components of a force<br><br>Principle of Superposition<br><br>Equations of Equilibrium | SLO 2, 3 |
| Session 3 | Focus on applying the basic principles of statics to real-life statics problems. Analyze forces and the mechanics of materials for structural elements and structural assemblies. Description of method for applying Newton's Laws of Motion to the solution of statics problems.<br><br>Examples of analyzing simple structural members.<br><br>**STRUCTURAL ANALYSIS: Reactions -** Present method for solving for reactions of statistically determinate beams and trusses. Sample examples. | SLO 2, 3 |
| Session 4 | **Trusses:** Study simple methods for solving forces in truss members. Sample examples.<br><br>**Cables:** Describe simple method for solving tensile forces in cables. Sample examples. | SLO 2, 3 |

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| Session 5 | **Structural analysis** of trusses, beams, and frames including determinate and indeterminate structures. Sample examples.<br><br>Deflections of beams and frames. | SLO 2, 3, 4 |
| Session 6 | **DESIGN OF STEEL STRUCTURES**<br><br>**Introduction:** Steel properties, design load and load factors, Types and shapes of structural steel members, safety factors.<br><br>**(Steel) Flexural Members:** Design of laterally supported and unsupported beams, deflection. | SLO 1, 2, 3, 4 |
| Session 7 | (Steel) Design of beams for heavy concentrated loads.<br><br>(Steel) Design of beams with unsymmetrical cross-section and unsymmetrical bending. Design of girders | SLO 2, 3 |
| Session 8 | **(Steel) Compression Members:** Design & analysis of axially loaded columns, Analysis and design of eccentrically loaded columns.<br><br>(Steel) Length effects and evaluation of effective length factor for columns in braced and unbraced frames.<br><br>Review statics, structural analysis, and design of steel structures. | SLO 1, 2, 3, 4 |
| Session 9 | **Midterm Exam** | |

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| Session 10 | Review of Midterm exam<br><br>**Steel Connections:** Types of high strength bolts and rivets, friction & bearing type connections,<br><br>fasteners subjected to eccentric loads, design of seated beam connection, continuous beam-to-beam and beam to-column connection.<br><br>**Reinforced Concrete Construction (RCC) Design**<br><br>**Basic Principles of Reinforced Concrete:** Basic principles of reinforced concrete design and associated assumptions, behavior of reinforced concrete members in flexure, design philosophy, factor of safety and load factors, prevailing methods of design of reinforced concrete members. | SLO 1, 2, 3, 4, 5 |
| Session 11 | **(RCC) Working Stress Method of Analysis:** Working stress method, serviceability criteria and checks for deflection, crack width, and crack spacing, importance of working stress method related to pre-stress.<br><br>**(RCC) Ultimate Strength Method:** Ultimate strength method, analysis of prismatic and non-prismatic sections in flexure, | SLO 4, 5 |
| Session 12 | **(RCC) Ultimate Strength Method:** Compatibility based analysis of sections and code requirements for flexure.<br><br>**(RCC) Concrete Analysis** of one-way solid and ribbed slabs, two way solid slabs with general discussion on other slab systems, design for flexure | SLO 4, 5 |
| Session 13 | **(RCC) Concrete Analysis (cont'd)** of one-way solid and ribbed slabs, two way solid slabs with general discussion on other slab systems, design for flexure<br><br>**(RCC) Shear in Beams:** Shear stress in reinforced concrete sections, models and analogies towards solution of diagonal tension problem, design for diagonal tension | SLO 4, 5 |

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| Session 14 | **(RCC) Concrete Bond, Anchorage & Development Length:** Design and detailing for bond, anchorage, development length, laps and splices.<br><br>**(RCC) Concrete Columns:** Analysis of sections in pure compression, design of short columns under pure compression and with eccentric loading.<br><br>**(RCC) Concrete Footings:** Isolated footings, structural design of simple rectangular footing and combined footing. | SLO 4, 5 |
| Session 15 | **Final Exam** | |

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