Hong Kong University of Science and Technology
Department of Civil and Environmental Engineering

Rubric Title of course Instructor Teaching Assistant	**CIVL 2110** **Statics** Jishen Qiu To be determined
Prerequisites Co-requisites Exclusive Credit	• *MATH 1012 Calculus 1A* (or any courses on calculus including but may not limited to *MATH 1013 Calculus 1B*, *MATH 1023 Accelerated Calculus I*, etc.) • *PHYS 1111 General Physics I* (or any courses on general physics including but may not limited to *PHYS 1112 General Physics II*, etc.) • *MATH 1014 Calculus II* or *MATH 1024 Honors Calculus II* • *CIVL 2150 Introduction to Statics and Dynamics* 3
Textbook(s) and/or Other materials	• Hibbeler R.C. "Engineering Mechanics, Statics: 13th edition in SI Units", Pearson Education, 2012. • Beer F., Johnston E.R., et al. "Vector Mechanics for Engineers: Statics, 10th edition in SI Unites", McGraw-Hill, 2013
Course Objectives	By successfully completing this course, a student would be able to • Reduce a loaded structure to a model, i.e. creating proper free-body diagrams (FBD) of the structure or the parts in it. • Examine the stability of this structure, and classify a stable structure as the statically determinate or indeterminate • Perform static analysis to a statically indeterminate structure, e.g. truss or certain frames • Calculate and sketch the internal force in a structural member, e.g. axial force, shear force, bending moment. • Identify the structural analysis that is NOT covered in this course, and what future courses (e.g. mechanics of materials, structural analysis), will cover the relevant topics.
Topics	1. Understanding forces and moments • Overview of mechanics • Vectors (introduction, Cartesian coordinates) • Operation of vectors and their applications (addition, dot product, cross product, mix product) 2. Equivalent systems of forces and equilibrium • Equivalent system of forces • Equilibrium of rigid body (single and multiple) • Two-force and three-force members 3. Stability and static determinacy • Stability • Static determinacy • Kinematic approach for stability analysis (single or multiple rigid bodies) 4. Trusses • Introduction and classification of trusses • Analysis of trusses (method of joints, method of sections) • Computer-aided analysis of trusses 5. Area properties and moments of inertia • Area and centroid

	• Distributed loading • Pappus-Guldiness Theorem • Moments of Inertia • Parellel axis theorem • Rotated axes • Mohr's Circle 6. Internal force diagram • Understanding axial force, shear force, and bending moments • Shear diagram • Axial force diagram • Bending moment diagram 7. Static analysis of a structure • Static analysis of a structure • Bending moment diagram using fast track approach
Computer usage	To be advised by the lecturer
Lab Projects	No lab work required
Class/lab schedule	Two 80-minute lectures per week One 60-minute tutorial per week
Contribution to the professional component	100% engineering topics
Relationship to the program objective	This course contributes to the following program objectives: ***1. Provide professional skills in design, construction and management*** • Student will learn statics as the fundamentals of structural design, and the physical laws and mathematical tools related to the structural analysis. ***3. Stimulate self-learning and innovative problem solving skills*** • The students will spend a good time to practice statics problems independently. • The students will be encouraged to develop unorthodox method to define a structure, to solve a problem. ***4. Expose students to real projects and cutting edge research.*** • The structures to be analyzed in this course will resemble the real-world engineering problems, and even some cutting-edge scientific research (e.g. micromechanics in biomaterials)
Relationship to program outcome	The course contributes to the following program outcomes: ***1. Obtain fundamental knowledge in mathematics and science (T, P, M)*** • The lecturer will teach, the students will practice and be able to mathematics, e.g. vector operation, trigonometry, and matrix operation, to define and solve problems of mechanics • The lecturer will teach, the students will practice and be able to apply physics, e.g. Newtonian Laws, to analyze structures. ***2. Understand fundamental principles of engineering science (T, P, M)*** • The lecturer will teach, students will practice and master fundamental concepts on engineering mechanics, e.g. equilibrium, stability, static determinacy, etc. • The lecturer will teach, the students will practice and be able to transfer some practical engineering problems to a model that can be solved with fundamental engineering tools like free-body diagram, Mohr's circle. 4. ***Apply modern engineering tools (T, P)*** • The instructor will teach, and the students will practice fundamental programing concepts for the analysis of truss. ***5. Formulate problems and propose feasible solution (T, P)***

	• The instructor will teach, and the students will be transforming a loaded structure in daily life (e.g. a rigid frame, a pulley, a cable-hung slab, etc.) to a model that can be analyzed by physical laws and mathematical tools. • The students will assess the model and carefully select the most efficient method to solve it. ***7. Appreciate the breath of civil engineering (T)*** • The instructor will cover a wide range of real-life infrastructures. • The instructor will stress that the analytical skills taught in this course can be applied in some other disciplines out of civil engineering, e.g. mechanical part. ***8. Obtain in-depth knowledge in at least one specialized area (T)*** • The instructor will teach so that students will appreciate fundamental concepts of structural engineering; they will be carry out quick qualitative analysis of specific simple types of structures. ***10. Recognize the need of lifelong learning (T)*** • The instructor will emphasize the role of fundamental mechanics for the students' future professional career, and more importantly why applying the analytical skill would be critical. ***11. Install a deep sense of professional responsibility and ethics (T)*** • The instructor will involve recent cases of structural failure, and explain how the knowledge of statics can be applied in this cases.
Assessment of Outcomes	• A mid-term (30%) and final exam (50%) will be held to assess students' understanding in the subject during the learning process. (Outcomes 1, 2, 5, 8). • Seven assignments of homework and a few quizzes (20%) will be used to assess student's learning pace (Outcomes 1, 2, 5, 8) • Class discussions and tutorials will be taken advantage of to understand how well the students can relate the class content to real-world problems. (Outcomes 4, 7, 8, 10, 11)
Prepared by	Jishen Qiu
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