NANYANG TECHNOLOGICAL UNIVERSITY

Teaching, Learning and Pedagogy Division

Reg. No. 200604393R

PROPOSED COURSE OUTLINE TEMPLATE FOR STUDENTS AT NTU

Academic Year	AY2017/18	**Semester**	1
Course Coordinator	Dr Cise Unluer (CEE)		
Course Code	CV2711		
Course Title	Civil Engineering Laboratory A		
Pre-requisites	Nil		
No of AUs	1		
Contact Hours	Lecture: 0 hrs; Tutorial: 0 hr; Lab: 30 hr.		
Proposal Date	3 December 2017		

Course Aims

Laboratory work is an integral part of engineering training provided at NTU. It complements the lectures and tutorials, and provides a form of visual aid to theories which are often difficult to explain in words. Laboratory session aims to provide you with a hands-on practical experience in collecting, analysing and discussing experimental data in relation to the theories learned in lectures.

Intended Learning Outcomes (ILO)

By the end of this course, you would be able to:

1. Carry out experiments and verify theories in CEE courses relating to fluid mechanics, environmental engineering, soil mechanics and mechanics of materials.
2. Carry out investigative open-ended projects to include independent methodology to relate theories and principles to experimental results on various test apparatuses relating to above courses.
3. Estimate percent uncertainty in experimental data and results.
4. Analyse, interpret and infer from experimental data and results.
5. Write a project report with professional and technical competency and clarity.

Course Content

EXPERIMENT CODE	TITLE OF EXPERIMENT	LABORATORY
A-1 (WR)	Hydrostatic Forces - Centre of Pressure	Hydraulics Studio
A-2 (WR)	The Energy Principle – Discharge Through an Orifice	Hydraulics Studio
A-3 (WR)	Impact of a Jet	Hydraulics Studio
A-4 (WR)	Friction Losses in Pipe Flow	Hydraulics Studio

A-5 (EN)	Water Quality Analysis	Environment Lab
A-6 (EN)	Wastewater Quality Analysis	Environment Lab
A-7 (GE)	Atterberg Limits and Grain Size Analysis	Geotechnics Lab
A-8 (GE)	Permeability and Quick Sand Model Observation	Geotechnics Lab
A-9 (CT)	Torsion	Protective Engineering Lab
A-10 (CT)	Beam Bending	Protective Engineering Lab

Note: CV2711 consists of 10 laboratory experiments, and each lab session is for 3 hrs.

Assessment (includes both continuous and summative assessment)

Component	**Course LO Tested**	**Related Programme LO or Graduate Attributes**	**Weighting**	**Team/Individual**	**Assessment rubrics**
Each Lab session	1 to 5	LO 1 to 5 CEE SLOs: (b), (e), (f), (j) EAB SLOs: (d), (e), (f), (h)	10%	Group test Individual report	
Total (for 10 Lab sessions)			100%		

Note:
Proposed new Civil Engineering Programme SLOs (2017):

Knowledge

(a) Competence in mathematics, science, information technology and modern engineering tools for the solution of civil engineering and sustainable infrastructure development problems;

Skills

(b) Ability to design and conduct experiments, analyse and interpret data, and synthesise valid conclusions for problems related to civil engineering and sustainable infrastructure development;
(c) Ability to design a system, component, or process, and synthesise solutions for complex problems in civil engineering and sustainable infrastructure development to achieve desired needs and understand the solutions' limitations;
(d) Ability to identify, formulate, research through relevant literature review, and solve civil engineering and sustainable infrastructure development problems reaching substantiated conclusions;
(e) Ability to use state-of-the-art techniques, skills, and modern engineering tools necessary for civil engineering and sustainable infrastructure development practices with appropriate considerations for public health and safety, cultural, societal, and environmental constraints;
(f) Ability to communicate effectively;

Professional awareness and insight

(g) Ability to acquire knowledge for continual professional development in civil engineering through lifelong learning or pursue graduate study and recognize its importance;
(h) Awareness of the impact of civil engineering solutions in a societal context and to be able to respond effectively to the needs for sustainable development;
(i) Ability to function effectively within multi-disciplinary teams and understand the fundamental precepts of effective civil engineering and sustainable infrastructure project management;
(j) Ability to recognize the importance of ethics, and the need to uphold high moral standards in relation to professional conduct and apply appropriate ethical principles in practices

EAB's generic graduate attributes (SLOs)

(a) **Engineering knowledge**: Apply the knowledge of mathematics, natural science, engineering fundamentals, and an engineering specialisation to the solution of complex engineering problems.
(b) **Problem Analysis**: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
(c) **Design/development of Solution**s: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
(d) **Investigation**: Conduct investigations of complex problems using research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
(e) **Modern Tool Usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
(f) **The engineer and Society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
(g) **Environment and Sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for the sustainable development.
(h) **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
(i) **Individual and Team Work**: Function effectively as an individual, and as a member or leader in diverse teams and in multidisciplinary settings.
(j) **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
(k) **Project Management and Finance**: Demonstrate knowledge and understanding of the engineering and management principles and economic decision-making, and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
(l) **Life-long Learning**: Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Formative feedback

The reports submitted by the students will be marked by TAs, who will enable you to see your progress via the feedback they receive through the reports and the lab sessions.

Learning and Teaching approach

Approach	How does this approach support students in achieving the learning outcomes?
Attend briefing	Learn theoretical foundation and test procedure (ILO -1).
Conduct experiments	Learn hands-on practical experience (ILO – 2,3).
Write Lab report	Learn skills on collecting, analysing and discussing experimental data (ILO – 1,3,4,5).

Reading and References

Lab manuals will be provided at the beginning of the semester, which include related theories and test procedure, as well as lab report requirement.

Course Policies and Student Responsibilities

Students must follow the lab protocols and regulations stated during the safety briefings at all times.

Academic Integrity

The students are reminded at the beginning of the lab sessions that any students who are found to copy other students' report will be penalized.

Course Instructors

CV2711 is conducted by TAs with assistance from lab technical staff, and is coordinated by Dr Cise Unluer (ucise@ntu.edu.sg).

Planned Weekly Schedule

The lab sessions start from week 2, and will usually end at week 12. The schedule is determined each semester in line with the course content listed above.

Week	Topic	Course LO	Readings/Activities
2-10	See course content	1-5	Manuals, experimental procedure, data analysis, discussion, report writing

Assessment Rubrics for Laboratory

	Performance Level/Criteria			
Performance Indicators/Course LO Tested	**Outstanding: 4**	**Good: 3**	**Average/meet expectations: 2**	**Below expectations: 1**
Carry out experiments and verify theories (LO 1 and 2)	Excellent ability in understanding key concepts and theories involved in the experiments	Good ability in understanding key concepts and theories involved in the experiments	Ability in understanding key concepts and theories involved in the experiments	Unable to understand key concepts and theories involved in the experiments
Estimate uncertainties and analyse data (LO 3 and 4)	Excellent ability in estimating uncertainties and performing data analysis	Good ability in estimating uncertainties and performing data analysis	Ability in estimating uncertainties and performing data analysis	Unable to estimate uncertainties and performing data analysis
Write technical reports (LO 5)	Excellent ability in presenting results and completing a report	Good ability in presenting results and completing a report	Ability in presenting results and completing a report	Unable to present results and completing a report