Subject Description Form

Subject Code	CSE30306
Subject Title	Hydraulics and Hydrology
Credit Value	3
Level	3
Pre-requisites/ Exclusion	Pre-requisites: CSE29202 Fluid Mechanics or CSE29207 Introduction to Fluid Mechanics for ESD
Objectives	The objective is to provide students with the basic knowledge in the analysis and design of hydraulic system commonly found in Hong Kong and other countries. Students will be equipped with the knowledge to integrate fluid mechanics, engineering hydrology, cost and time consideration in selecting the suitable drainage and water supply system to meet the needs of the client. Students should be able to integrate the knowledge in engineering to prepare a good feasibility study, to carry out detailed analysis and design with due considerations to the environment as well as the cost and time of construction.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Able to apply the basic principles of fluid mechanics to analyze and formulate creatively effective solutions to hydraulic engineering and engineering hydrology problems; b. Able to apply contemporary numerical tools to model drainage problems and to design logical and cost-effective solutions utilizing pipes or open channels as conveyors; c. Able to evaluate the performance of pipe networks and channel control structures, and to establish local rainfall-runoff correlations through a combination of theoretical and empirical studies; d. Able to explain hydraulic and hydrological problems and their solutions logically and lucidly through drainage design calculations, drawings and technical reports; e. Able to appreciate the limitations and inadequacies of current hydraulic analysis tools and the need for continual enhancement of existing theories and methods; f. Able to embrace more advanced hydraulic theories and analysis techniques after graduation based on a thorough understanding of basic hydraulic principles, including their practical applications. g. recognize the need for, and to engage in life-long learning
Subject Synopsis/ Indicative Syllabus	1. <u>Pipeflow</u> (4 weeks) Darcy equation, friction factor, effect of roughness. Pipes in parallel & in series. Minor losses. Pipe networks. Quasi-steady flow in pipes. 2. <u>Open Channel Flow</u> (4 weeks) Uniform flow. Specific energy. 'Total force' (or momentum). Critical depth.

Gradually varied steady flow. Energy equation for channels of rectangular cross-section. Calculation of surface profiles for mild, critical and steep slopes. Profile classifications.

Profile combination determined by change of slope, sluices, spillways and the like. Occurrence and location of the hydraulic jump. Conditions governing the formation of critical conditions, use as channel control and in determining flow. Channel structures: gates, spillways, syphons, energy dissipators, protection from scour.

3. Hydrology (5 weeks)
The hydrological cycle. Measurement of precipitation. Estimation of evaporation and other losses. Infiltration and percolation. Groundwater flow. Surface runoff: flow rating curves, duration of runoff, catchment characteristics, climatic factors and rainfall/runoff correlation. Hydrograph analysis: baseflow, unit hydrographs. Flood routing: storage equation, reservoir routing and routing in river channel.

4. Laboratory Work
Yield of wells, pipe friction, uniform open channel flow, gradually varied flow.

Teaching/Learning Methodology

In the lecture programme, fundamental knowledge relating to pipe flow, open channel flow and hydrology will be established. Students will be required to undertake various coursework activities which will enable them to thoroughly digest the taught materials. Tutorials will provide opportunities for students and lecturers to communicate and discuss any difficulties relating to lecture programme. It will also provide a forum for students and lecturer to discuss the ongoing coursework and laboratory activities.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)						
		a	b	c	d	e	f	g
1. Laboratory reports	10	✓	✓	✓	✓	✓	✓	✓
2. Seminar report	5					✓	✓	✓
3. Assignments	5	✓	✓	✓	✓			
4. Mid-term test	10	✓	✓	✓	✓	✓	✓	
5.Final Examination	70	✓	✓	✓	✓	✓	✓	
Total	100 %							

<table>
<tr><td></td><td colspan="2">Students must attain at least grade D in both coursework and final examination (whenever applicable) in order to attain a passing grade in the overall result.

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Assignments and laboratory reports are used to test students' ability in achieving the intended learning outcomes through a more in-depth investigation of a particular subject issue.

To widen our students' exposure in their field of study, students are required to attend 1 seminar for submission of seminar report pertinent to this subject.

Mid-term test and final examination are used to test students' overall ability in achieving the intended learning outcomes.</td></tr>
<tr><td rowspan="6">Student Study Effort Expected</td><td>Class contact:</td><td>Average hours per week</td></tr>
<tr><td>▪ Lectures / Tutorials / Laboratory</td><td>3 Hrs.</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ Reading and Study</td><td>3 Hrs.</td></tr>
<tr><td>▪ Completion of seminar report, assignments and laboratory reports</td><td>3 Hrs.</td></tr>
<tr><td>Total student study effort</td><td>9 Hrs.</td></tr>
<tr><td>Reading List and References</td><td colspan="2"><u>Essential Textbooks</u>

J.F. Douglas, J.M. Gasiorek & J.A. Swaffield, "Fluid Mechanics", 6th Edition, Prentice Hall, 2011.

E.M. Wilson, "Engineering Hydrology", 4th Edition, Macmillan, 2011.

<u>Reference Textbooks</u>

K.W. Chau, "Use of Meta-Heuristic Techniques in Rainfall-Runoff Modelling," MDPI AG, Switzerland, 2017, 260p. (ISBN: 978-3-03842-326-3)

K.W. Chau, "Modelling for Coastal Hydraulics and Engineering", Taylor & Francis, UK, 2010, 240pp. (ISBN: 978-0-415-48254-7).

K.W. Chau & C.L. Wu, "Hydrological Predictions: Using Data-Driven Models Coupled with Data Preprocessing Techniques," LAP LAMBERT Academic Publishing, Germany, 2010, 248pp. (ISBN: 978-3-8433-6446-1)</td></tr>
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	K.W. Chau, "Knowledge-Based System for Analysis and Design of Liquid Retaining Structures," Nova Science Publishers, USA, 2011, 159p. (ISBN: 978-1-61209-550-9) C. Nalluri & R.E. Featherstone, "Nalluri & Featherstone's Civil Engineering Hydraulics: Essential Theory with Worked Examples", 5th Edition, Rev. by Martin Marriott, Wiley-Blackwell, 2009. E.J. Finnemore & J.B. Franzini, "Fluid Mechanics with Engineering Applications", 10th Edition, McGraw-Hill Education, 2002. V.T. Chow, D.R. Maidment & L.W. Mays, "Applied Hydrology", McGraw-Hill Education, 1988.