SULTAN QABOOS UNIVERSITY
DEPARTMENT OF CIVIL AND ARCHITECTURAL ENGINEERING

COURSE OUTLINE

Engineering Hydrology (CIVL 3066)
Spring 2009

Instructor:	Dr. Ahmad Sana
Time & Place:	Sun. 16:15-18:05 (CMT/C10); Tue. 16:15-18:05 (CMT/C10)
Office Hours:	Sun. and Tue.12:00-12:50 , Mon. 09:00-12:50
Office:	Room # 2078, College of Engineering Western Building
Telephone:	Ext. 2524
Email:	sana@squ.edu.om
Homepage:	http://ahmadsana.tripod.com

I. Course Description

CIVL 3066 ENGINEERING HYDROLOGY (3 Credits)
Introduction to Hydrology, Hydrologic Processes, Atmospheric and Subsurface Water and hydrologic measurements. Unit Hydrograph, Statistics. Hydrologic Design. Design Storm.

II. Required Background or Experience

Prerequisites by course:

CIVL 4046, MATH 3171

Prerequisites by topic:

1. Fundamentals of algebra and arithmetic.
2. Basic principles of physics.
3. Basic principles of fluid mechanics.

Post-requisites:

None

III. Course Objectives

The objectives of this course are to give the student a fundamental knowledge of:

1. Components of the hydrologic cycle **[Obj. A]**.
2. Calculation of the average rainfall over a watershed **[Obj. A, C]**.
3. Calculation of evaporation and evapotranspiration **[Obj. A, C]**.
4. Measurement of streamflow **[Obj. A, C]**.
5. Separation of the surface runoff from the streamflow in a hydrograph **[Obj. A]**.
6. Derivation of a unit hydrograph for a watershed **[Obj. A, C]**.
7. Application of the unit hydrograph to determine streamflow as a result of a rainfall **[Obj. A, C]**.

8. Calculation of the infiltration in a watershed using Green-Ampt method **[Obj. A, C]**.
9. Hydrologic river and reservoir routing **[Obj. A, C]**.
10. Governing equations for hydraulic river routing and Muskingum-Cunge method **[Obj. A, C]**.
11. Introduction to HEC-HMS and its applications **[Obj. A, C]**.
12. Uniform and gradually varied flow computations in channels **[Obj. A]**.
13. Introduction to HEC-RAS and its applications **[Obj. A, C]**.

Civil Engineering Program Educational Objectives

Objective A. Provide the required knowledge and skills to solve Civil Engineering problems.

Objective B. Expand and enhance the abilities related to the responsibilities of the Civil Engineer towards the profession and society.

Objective C. Develop the abilities to stay current with new developments.

IV. Expected Outcomes

Students will be expected to develop these skills/understanding upon the successful completion of this course:

1. Understand the components of hydrologic cycle **[a]**.
2. An ability to calculate the average rainfall over a watershed **[a, c]**.
3. An ability to calculate evaporation and evapotranspiration **[a, c]**.
4. Understand measurement of streamflow **[a, c]**.
5. An ability to carry out separation of the surface runoff from the streamflow in a hydrograph **[a]**.
6. An ability to derive a unit hydrograph for a watershed **[a, c]**.
7. An ability to apply the unit hydrograph to determine streamflow as a result of a rainfall **[a, c]**.
8. An ability to calculate the infiltration in a watershed using Green-Ampt method **[a, c]**.
9. An ability to perform hydrologic river and reservoir routing **[a, c, k]**.
10. Understand governing equations for hydraulic river routing and Muskingum-Cunge method **[a, c, k]**.
11. An ability to use HEC-HMS **[k]**.
12. An ability to carry out uniform and gradually varied flow computations in channels **[a, c]**.
13. An ability to use HEC-RAS **[k]**.

ABET Program Outcomes and Assessment (Criterion 3)

(a) An ability to apply knowledge of mathematics, science, and engineering.

(b) An ability to design and conduct experiments, as well as an ability to analyze and interpret data.

(c) An ability to design a system, component, or process to meet desired needs.

(d) An ability to function on multi-disciplinary teams.

(*e*) *An ability to Identify, formulate and solve engineering problems.*

(f) An understanding of professional and ethical responsibility.

(g) An ability to communicate effectively.

(h) The broad education necessary to understand the impact of engineering solutions in a global and societal context.

(i) A recognition of the need for, and an ability to engage in life-long learning.

(*j*) *The knowledge of contemporary issues.*

(*k*) A*n ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.*

V. Course Contents

The following topics will be covered in this course:

1. Hydrologic Principles: Introduction, Hydrologic cycle, Weather systems, Precipitation, Evaporation and ET, Infiltration loss, Streamflow and hydrograph, Hydrologic measurement.
2. Hydrologic Analysis: Watershed concept, Rainfall-runoff, Hydrograph analysis, Unit hydrograph, Synthetic unit hydrograph, Green and Ampt infiltration method.
3. Flood Routing: Hydrologic and hydraulic routing, Hydrologic reservoir routing, Governing equations for hydraulic river routing, Movement of a flood wave, Kinematic wave routing, Muskingum-Cunge method of hydraulic river routing.
4. Hydrologic Simulation Models: Introduction, Steps in watershed modeling, Description of major hydrologic models, Introduction to HEC-HMS, HEC-HMS watershed analysis-Case study.
5. Floodplain Hydraulics: Uniform flow, Uniform flow computations, Specific energy and critical flow, Occurrence of critical depth, Nonuniform or gradually varied flow, Gradually varied flow equations, Classification of water surface profiles, Hydraulic jump, Introduction to HEC-RAS, Application of HEC-RAS-An example.

VI. Textbook(s) and Readings

- Hydrology and Floodplain Analysis (4^{th} Ed.) by Philip B. Bedient, Wayne C. Huber and Baxter E. Vieux, Pearson, 2007
- Applied Hydrology by V.T. Chow, D.R. Maidment and L.W. Mays, McGraw-Hill, 1988.

VII. Minimum Student Materials

Text, engineering calculator, and an access to personal computers.

VIII. Minimum College Facilities

Classroom with whiteboard and projection facilities, Hydraulics laboratory, library, computer facilities.

IX. Instructional Methods

1. Lectures.
2. Teamwork solving problem tutorials.
3. Experiments
4. Homework.
5. Reading assignments.

X. Evaluation of Outcomes

Evaluation will be based on the following:

1.	Assignments	[15%]
2.	Quizzes	[15%]
3.	Experiments	[10%]
4.	Design Problems	[10%]
5.	Mid-Term Examination	[20%]
6.	Final examination	[40%]

XI. Explanation of grading system

Assignments (15%): There will be approximately three assignments. Whenever an assignment is given, you will have one week to complete it and submit. Group participation in solving an assignment problem is encouraged, however, you must turn in your own assignment. Late assignments would be accepted only with prior approval from the instructor.

Quizzes (15%): There will be approximately three quizzes. They will consist of multiple-choice questions and brief definitions. The students must be prepared and revise the material covered in the preceding lectures before coming to the class.

Experiments (10%): There will be two experiments. Please bring your textbook and calculator every time you come to attend the experiment. The results of the experiment have to be submitted on the day the experiment is performed and the final report is to be submitted within one week.

Design Problems (10%): There will be two design problems. You are required to submit the solution in the form of a written report.

Mid-term examination (10%): This will be a closed book examination, covering all the theory, problems, tutorial exercises and laboratory experiments completed prior to it.

Final examination (40%): The final examination will be a closed book examination covering the whole course contents completed in the semester.

Extra credit (up to 5%): The students may receive up to 5% of their grade in extra credit by attending seminars and professional society meetings held in the civil engineering department or relevant conferences. In order to get this credit write down an essay describing your contributions to the engineering society work and seminar attendances, and get it endorsed by the Engineering Society Advisor of the department.

XII. Professional Component Contribution

CIVL 3066 is a departmental required course that deals with the basic concepts of hydrology. Two thirds of the contents of this three credit course consist of engineering science. The remaining one third is an essential part of water resources design.

XIII. Detailed schedule of the course

S. No.	Topic	Week													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Hydrologic Principles															
2	Hydrologic Analysis															
3	Flood Routing															
4	Hydrologic Simulation Models															
5	Floodplain Hydraulics															
6	Case studies using HEC-HMS and HEC-RAS															

Quiz and Exam. Schedule

Quiz 1: Sunday, March 1, 2009
Quiz 2: Sunday, March 29, 2009
Quiz 3: Sunday, April 26, 2009
Mid-Term Exam.: Tuesday, April 7, 2009
Final Exam. : Monday, May 18, 2009