



Course Specifications

Course Title:	Seepage Analysis and its control
Course Code:	CE 439
Program:	B.Sc. in Civil Engineering
Department:	Civil Engineering
College:	Jubail University College
Institution:	Jubail University College

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A. Course Identification

1. Credit hours:	3
2. Course type	
a.	University <input type="checkbox"/> College <input type="checkbox"/> Department <input checked="" type="checkbox"/> Others <input type="checkbox"/>
b.	Required <input type="checkbox"/> Elective <input checked="" type="checkbox"/>
3. Level/year at which this course is offered:	Level 6, Third Year (Elective) Level 7, Fourth Year (Elective)
4. Pre-requisites for this course (if any):	CE 315 Geotechnical Engineering I
5. Co-requisites for this course (if any):	None

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	✓	100
2	Blended		
3	E-learning		
4	Correspondence		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
Contact Hours		
1	Lecture	45
2	Laboratory/Studio	
3	Tutorial	
4	Others (specify)	
	Total	45

B. Course Objectives and Learning Outcomes

1. Course Description
<i>CE439 Seepage Analysis and its Control (3-0-3)</i> <i>Prerequisite: CE315</i>
Principles that govern the flow of water into soils; equation of continuity and potential theory; flow nets; confined flow; unconfined flow; seepage forces and critical gradient; applications of seepage principles to earth structures; seepage from canals and ditches; seepage into wells; filters and drains; review of selected case histories.
2. Course Main Objective
The main purpose of this course is to enable the students to acquire the knowledge about the principals involved in the seepage analysis of earthen structures and solve the seepage and its control problems in canal, ditches and wells.

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	Knowledge and Understanding	
	N/A	
2	Skills	
2.1	Discuss Darcy's law and its application to water flow problems and seepage principles involved in seepage analysis	1
2.2	Apply the general water flow equation in seepage analysis	1
2.3	Measure the coefficient of permeability and seepage forces in the soil.	1
2.4	Analyze the seepage flow problems through earth structures	1
2.5	Use the concept of flow nets and its application in the seepage analysis	1
3	Values	
	N/A	

C. Course Content

No	List of Topics	Contact Hours
1	Unit 1. Flow of water through soil 1.1 Introduction to water flow through soil 1.2 Darcy's law, Validity of Darcy's law, Coefficient of permeability 1.3 Permeability of stratified soils ,Horizontal flow ,Vertical flow Factors affecting permeability ,Methods for determining permeability	6
2	Unit 2. Seepage principles 2.1 Introduction to seepage ,Seepage forces, 2.2 Critical hydraulic gradient , 2.3 Confined and unconfined flow 2.4 General flow equation for soil 2.5 Significance of Laplace's equation	6
3	Unit 3. Flow net and piping 3.1 Properties and application of flow net 3.2 Construction of flow net 3.3 boundary condition ,Construction methods ,Piping	6
4	Units 4. Seepage from canal and ditches 4.1 Seepage from a ditch with a curved perimeter into a horizontal drainage layer 4.2 Seepage from a ditch with a curved drainage layer , 4.3 Seepage from triangular and trapezoidal shaped ditches and canal Seepage from a ditch into permeable layers at shallow depth 4.4 Seepage from a shallow ditch considering capillarity.	12
5	Unit 5. Seepage towards wells 5.1 Introduction; fundamental equations; sources and sinks 5.2 Well and uniform flow ,Flow between two wells of equal strength 5.3 Influence of the shape of contour on discharge 5.4 Interference among wells 5.5 Partially penetrating well	9
6	Unit 6. Filter and drain design 6.1 Basic requirements of filters and drains	6

6.2 Prevention of piping ,Permeability requirements of filters and drains	
6.3 Use of flow nets and Darcy's law in the design of drains	
Total	45

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	Knowledge and Understanding		
	N/A		
2.0	Skills		
2.1	Discuss Darcy's law and its application to water flow problems and seepage principles involved in seepage analysis	Interactive learning Self-directed learning	Written exams (Quiz, midterm, Final) and Assignments
2.2	Apply the general water flow equation in seepage analysis		
2.3	Measure the coefficient of permeability and seepage forces in the soil.		
2.4	Analyze the seepage flow problems through earth structures		
2.5	Use the concept of flow nets and its application in the seepage analysis		
3.0	Values		
	N/A		

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Quiz 1	4	10%
2	Assignment 1	6	10%
3	Mid-term LT	8	20%
4	Quiz 2	12	10%
5	Assignment 2	14	10%
6	Final Exam LT	17-19	40%

*Assessment task (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- Office hours 5 hr/week; students can go in times of office hours for teacher to explain what could not be understood from the lesson.
- Students can communicate with a staff member outside the official working hours by email.
- Students are also encouraged to visit their academic advisors.

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	Braja, M.D. and Sobhan, K. (2014), <i>Principles of Geotechnical Engineering</i> , USA: Cengage Learning.
Essential References Materials	Harr M.E (2011). <i>Groundwater and Seepage</i> . New York :Dover publication Coduto D.P , Man-Chu R. Y. & Kitch W.A (2011). <i>Geo Technical Engineering Principles & Practices</i> . New York : Pearson
Electronic Materials	None
Other Learning Materials	None

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Lecture rooms with a capacity of at least 25 students and fitted with multimedia projector and a computer.
Technology Resources (AV, data show, Smart Board, software, etc.)	None
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	None

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment as per QMS-Policy-006 Feedback Survey, QMS-QAP-116 Monitoring Students' Satisfaction	Students	Indirect: Analyzing the results of the following surveys Course Evaluation Survey(CES), Program Evaluation Survey (PES), Student Experience Survey (SES)
Quality of Exam papers and Verifying Standards of Student Achievement as per QMS-Policy-004 Policy for Examinations and Marking, QMS-ACP-102 Procedure for Marking Examinations	Examination Committee	Direct: Peer review of examination papers and review or double check a minimum of three or 10% of answer papers. Verifying the entries in the Activity Mark Sheet.
Achievement of learning outcomes as per QMS-Policy-001 Course Review, QMS-CDP-106, QMS-CDP-112	Faculty	Direct: Course Report (Section B-3)

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Curriculum Review		
Implementation of the action plans based on previous semester as per QMS-Policy-001 Course Review, QMS-CDP-106 Procedure for Course Review, QMS-CDP-112 Procedure for Curriculum Review	Faculty	Direct and Indirect: Course report (Section G-1, G-2)
Monitoring Teaching and Learning as per QMS-Policy-005 Monitoring of Teaching and Learning	Chairperson/Program Director/Course Director	Indirect: Feedback by Chairperson/Program director/Course director. Program Delivery Record.
Effectiveness of planned Teaching Strategies QMS-Policy-001 Course Review	Faculty	Indirect: Course Report (Section B-4)
Course effectiveness and planning for improvement as per QMS-Policy-001 Course Review, QMS-CDP-106 Procedure for Course Review, QMS- CDP-112 Procedure for Curriculum Review	Faculty	Direct and Indirect: Course report (Section G-3)
Verifying Standards of Student Achievement and Quality of Exam papers as per QMS-ACP-119 External Assessment Review	Assessment External Reviewer	Direct: Report of assessment external reviewer. Review of sample of ten or 10% of student's assessments and coursework scripts.

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)

Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify))

Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	Civil Engineering Department Council
Reference No.	REG MIN-CED-10
Date	27-04-2020

Appendix A Revision Details

Revision no.	DESCRIPTION	Reference MoMs			
		DC		CDC	
		Sem	#	Sem	#
1	Revision of Course Teaching Strategies and action verbs based on the comments of NCAAA reviewer	392	4	392	4
2	Course Specification Template 2018	402			