



## Course Specifications

<b>Course Title:</b>	Pavement Engineering
<b>Course Code:</b>	CE 412
<b>Program:</b>	B.Sc. in Civil Engineering
<b>Department:</b>	Civil Engineering
<b>College:</b>	Jubail University College
<b>Institution:</b>	Jubail University College

## Table of Contents

<b>A. Course Identification</b> .....	<b>3</b>
6. Mode of Instruction (mark all that apply) .....	3
<b>B. Course Objectives and Learning Outcomes</b> .....	<b>3</b>
1. Course Description .....	3
2. Course Main Objective.....	3
3. Course Learning Outcomes .....	3
<b>C. Course Content</b> .....	<b>4</b>
<b>D. Teaching and Assessment</b> .....	<b>5</b>
1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods .....	5
2. Assessment Tasks for Students .....	5
<b>E. Student Academic Counseling and Support</b> .....	<b>5</b>
<b>F. Learning Resources and Facilities</b> .....	<b>6</b>
1. Learning Resources .....	6
2. Facilities Required.....	6
<b>G. Course Quality Evaluation</b> .....	<b>6</b>
<b>H. Specification Approval Data</b> .....	<b>7</b>

## A. Course Identification

<b>1. Credit hours:</b>	3
<b>2. Course type</b>	
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"/>
<b>3. Level/year at which this course is offered:</b>	Level 6&7, Third & Fourth Year
<b>4. Pre-requisites for this course (if any):</b>	CE 318 Transportation Engineering
<b>5. Co-requisites for this course (if any):</b>	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
<b>Contact Hours</b>		
1	Lecture	45
2	Laboratory/Studio	
3	Tutorial	
4	Others (specify)	
	<b>Total</b>	<b>45</b>

## B. Course Objectives and Learning Outcomes

<b>1. Course Description</b>		
<i>CE 412 Pavement Engineering (3-0-3)</i>	<i>Prerequisite: CE 318</i>	
Introduction to pavement engineering; Soil engineering for highways; Flexible pavement concepts; Flexible pavement design; Rigid pavement concepts; Rigid pavement design; Pavement evaluation, maintenance and management; application of computer software(s) related to pavement engineering.		
<b>2. Course Main Objective</b>		
The main purpose of this course is to prepare students to introduce the concepts of design, performance, evaluation and maintenance of rigid and flexible pavements.		
<b>3. Course Learning Outcomes</b>		
	<b>CLOs</b>	<b>Aligned PLOs</b>
1	<b>Knowledge and Understanding</b>	
1.1	Define pavements, its types and structural components	8

CLOs		Aligned PLOs
1.2	Explain the basic engineering properties of soil in the construction of pavements and properties of pavement materials	8
<b>2</b>	<b>Skills</b>	
2.1	Design of asphalt mix for flexible pavement	1
2.2	Design of flexible and rigid pavement structural components.	1
2.3	Evaluate the Failure modes of a flexible and rigid pavements and techniques using in maintenance and management	1
2.4	Design of pavements using computer software	2
<b>3</b>	<b>Values</b>	
	N/A	

### C. Course Content

No	List of Topics	Contact Hours
1	<b>Unit 1 : Introduction to pavement engineering</b> 1.1 Definitions 1.2 Importance of pavement 1.3 Pavements types. 1.4 Traffic analysis and design considerations	6
2	<b>Unit 2 : Soil engineering for highways</b> 2.1 Basic engineering properties of soil 2.1 Soil stabilization	3
3	<b>Unit 3 : Flexible pavement concepts and design</b> 3.1 Structural components and its types 3.2 Properties of aggregates 3.3 Asphalt materials and testing 3.4 Asphalt mix design and testing 3.5 Structural design of flexible pavements (AASHTO method) 3.6 Application of software in design	15
4	<b>Unit 4 : Rigid pavement concepts and design</b> 4.1 Structural components 4.2 Types of rigid pavements 4.3 Materials used in rigid pavement 4.4 Structural design of rigid pavements (AASHTO method) 4.5 Application of software in design	12
5	<b>Unit 5 : Pavement evaluation, maintenance and management</b> 5.1 Introduction and basic concepts 5.2 Failure modes of a flexible and rigid pavements 5.3 Pavements condition and its evaluation 5.4 Pavement maintenance and rehabilitation 5.5 Pavement management system ( PMS )	9
<b>Total</b>		<b>45</b>

## 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	<b>Knowledge and Understanding</b>		
1.1	Define pavements, its types and structural components	Interactive learning Self-directed learning	Quiz 1, midterm, assignment1
1.2	Explain the basic engineering properties of soil in the construction of pavements and properties of pavement materials		Quiz 1, Assignment1,midterm, Quiz 2, assignment 2 & final
2.0	<b>Skills</b>		
2.1	Design of asphalt mix for flexible pavement	Interactive learning Self-directed learning	Quiz 1, midterm, assignment1
2.2	Design of flexible and rigid pavement structural components.		Assignment1,midterm, Quiz 2, assignment 2 & final
2.3	Evaluate the Failure modes of a flexible and rigid pavements and techniques using in maintenance and management		Quiz 2, assignment 2 & final
2.4	Design of pavements using computer software		assignment 2
3.0	<b>Values</b>		
	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

<b>Required Textbooks</b>	<a href="#">Garber, N. J.</a> and <a href="#">Hoel, L. A.</a> (2010). <i>Traffic and Highway Engineering</i> , USA: Cengage Learning
<b>Essential References Materials</b>	<a href="#">Myer, K.</a> (2003). <i>Handbook of Transportation Engineering</i> , USA: McGraw-Hill Handbooks <a href="#">Fricker, J.D</a> and <a href="#">Whitford, R.K</a> (2004). <i>Fundamentals of Transportation Engineering</i> , USA: Prentice Hall
<b>Electronic Materials</b>	None
<b>Other Learning Materials</b>	Pavement design software

### 2. Facilities Required

Item	Resources
<b>Accommodation</b> (Classrooms, laboratories, demonstration rooms/labs, etc.)	Lecture rooms with a capacity of at least 25 students and fitted with multimedia projector and a computer.
<b>Technology Resources</b> (AV, data show, Smart Board, software, etc.)	Pavement design software
<b>Other Resources</b> (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

<b>Council / Committee</b>	Civil Engineering Department Council
<b>Reference No.</b>	REG MIN-CED-10
<b>Date</b>	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			