Course Specification
(Bachelor)

Course Title:	Highway Engineering
Course Code:	CE 4303
Program:	Bachelor of Science in Civil Engineering
Department:	Civil Engineering
College:	College of Engineering & Architecture
Institution:	Umm Al Qura University
Version:	1
Last Revision Date:	31 January 2025

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A. General information about the course:

1. Course Identification

1. Credit hours: (3)					
2. Course type					
A.	☐ University	☐ College	☒ Department	☐ Track	☐ Others
B.	☒ Required		☐ Elective		
3. Level/year at which this course is offered: Level 10th / Year 5th					
4. Course General Description:					
The course covers highway design control and criteria. It encompasses cross section elements and highway geometric design. It covers structural design of flexible and rigid pavements. It includes empirical design by AASHTO procedures and Mechanistic - Empirical design approach. The impact of climate on serviceability and sustainability of flexible pavement tis also included. The lab portion of this course aims at characterization of subbase, base and surface course materials. The properties of asphalt concrete as a binder in flexible pavements and asphalt mix design is also included.					
5. Pre-requirements for this course (if any):					
CE 3301 CE 2202					
6. Co-requisites for this course (if any):					
7. Course Main Objective(s):					
The course main objectives are to develop the: • Ability to understand highway design controls and criteria, with considerations of cross section elements and highway geometric design. • Ability to apply AASHTO design procedures of highway flexible pavements and develop understanding about the basics of Mechanistic and Empirical pavement design. • Ability to apply AASHTO design procedures of highway rigid pavement, along with developing understanding about distresses and maintenance techniques.					

- Ability to develop expertise about testing procedures and characterization of highway materials, and undertake hot mix asphalt mix design.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	30	66.7
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		33.3
5	Other (laboratory)	15	15

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	45
3.	**Field**	
4.	**Tutorial**	
5.	**Others (specify)**	
Total		75

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	To demonstrate fundamental knowledge of controls and criteria for highway cross section and geometric design.	K1	• Through lectures, module notes, tutorials, coursework and examinations.	• Homework • Assessed out-of-class and in-class course works. Course works may be in the form of: laboratory and

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
				fieldwork technical reports, and class tests.
1.2	To illustrate flexible highway pavement procedures of AASHTO Empirical and Mechanistic-Empirical design methods.	K2	• Through lectures, group projects, tutorial exercises and work requiring detailed analyses.	• Written examinations • Design Projects • Class presentations.
1.3	To outline highway rigid pavements procedures as per AASHTO design procedures and criteria.	K2	Lab testing, evaluation and preparation of experimental reports. Works is also tested through quizzes and mid / end semester exams.	• Project reports, oral and written examination and term papers on design issues.
1.4	To demonstrate knowledge of engineering properties of pavement materials using relevant laboratory procedures and various asphalt mix design methods	K2	Lab briefings, discussions and experiments	• Lab testing reports Quizzes, oral and written tests
2.0	**Skills**			
2.1	To design highway horizontal and vertical alignments using specified design controls and criteria for various cross section elements.	S3	• Through lectures, module notes, tutorials, coursework and examinations.	• Homework • Quizzes • Mid semester examinations Design projects
2.2	To solve highway design problems using AASHTO procedures for flexible and rigid pavements, comparing empirical procedures with Mechanistic - Empirical pavement design using modern	S4	• Through group project work that will require detailed consideration • Presentations on various individual and assignments	• Written examinations • Design project report • Oral and written examinations Term papers

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	engineering tools.			
2.3	To formulate relevant analysis, compare options and develop the solutions.	S4	Through detailed analysis of various design options, presentation of technical reports and discussions	Lab testing and preparation of detail technical reports. Quizzes, home works and mid / end semester exams
2.4	To undertake characterization of highway materials and asphalt mix design by various methods.	S4	Term paper and technical report writing exercises are assigned to students.	Evaluation is mainly based on presentations and oral examinations
3.0	**Values, autonomy, and responsibility**			
3.1	To integrate professionally and ethically with multi-disciplinary teams in highway engineering projects, material characterization and laboratory testing.	V1	• Through lectures, tutorials, coursework and group project work. Through supervised practical work	• Assessed out of class and in-class coursework, including evaluation of laboratory and fieldwork reports, design calculations.
3.2	To use professional codes for evaluating geometrical and structural highway design problems and demonstrate ability of life-long learning.	V2	Through supervised laboratory exercises following standard procedures	• Project reports and peer review of individual contributions to group work.
3.3	To use expertise in highway design projects for serving society and providing solutions for Hajj and Umrah.	V3	• Students are given undertake self-study assignments and encouraged to indulge in lifelong learning process. Real life design issues are discussed and assigned	• Observation during laboratory experiments and fieldwork activities. Presentations on real life issues.

C. Course Content

No	List of Topics	Contact Hours
1	Highway Design Controls and Criteria	5
2	Design Considerations for Cross Section Elements	5
3	Vertical and Horizontal Roadway Alignments	5
4	Earthwork Computation and Mass Diagram	5
5	Pavement Traffic Loading	5
6	AASHTO Flexible and Rigid Pavements Design Procedures	5
7	Introduction to Mechanistic-Empirical Design of Pavements	5
8	Roadside Design	5
9	Flexible Pavement Distresses	5
10	Rigid Pavement Distresses	5
11	Highway Drainage	5
12	Properties and Testing Procedures for Characterization of Subgrade Soils and Aggregates	5
13	Subgrade Soils Improvement Techniques and Properties and testing of Asphalt binder	5
14	Asphalt Mix Design Methods	5
15	Environmental Impact on Pavements	3
16	Revision and Tutorials	2
Total		75

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Homework - Assignments	Weekly	5%
2.	Quizzes	3, 6, 9	5%
3.	Midterm Exam	10	25%
4.	Lab	3,6,8,12,14	15%
5.	Final Exam	16 / 17	50%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	• Rogers, M., & Enright, B. (2023). *Highway engineering*. John Wiley & Sons. • Garber, N. J., & Hoel, L. A. (2009). *Traffic & highway engineering*. • Wright, P. H., & Dixon, K. (2004). Highway engineering.
Supportive References	• Mannering, F. L., & Washburn, S. S. (2020). *Principles of highway*

	engineering and traffic analysis. John Wiley & Sons. • Garber, N. J., & Hoel, L. A. (2009). *Traffic & highway engineering*.
Electronic Materials	• http://www.sciencedirect.com. • http://www.trb.org/Main/Home.aspx • http://www.ite.org/ • https://bookstore.transportation.org/ • http://www.trl.co.uk/reports-publications/
Other Learning Materials	• Latest Highway Engineering Software • Civil Engineer Journals • Supplementary Class Notes • Laboratory Manual, especially prepared for the class.

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classroom for about 40 students, with white board, computer, projector and internet.
Technology equipment (projector, smart board, software)	Computing Services provides the University IT facilities and infrastructure. General purpose computer resources across campus are open 24 hours and more specialist computer laboratories are provided in partnership with departments. Students in halls of residence are supported in connecting their computers to the high speed network. The University's virtual learning environment "LEARN" provides on and off campus access to web-based teaching materials provided by lecturing staff.
Other equipment (depending on the nature of the specialty)	Well-equipped computer lab, asphalt lab and libraries are available for students for addition resource.

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Faculty members who teach this course and the lab staff associated with the course.	**Both written and verbal, through presentations. Analysis of students` marks. Regular feedback of the students about the course and the teaching methods**
Effectiveness of Students assessment	Faculty members who teach this course and those teaching other courses relevant to this	**Regular revising and improving of the course contents and consulting**

Assessment Areas/Issues	Assessor	Assessment Methods
	course.	the faculty members. Teaching faculty and lab staff associated with the course are also available for personal consultation.
Quality of learning resources	Faculty members who teach this course	Frequent improvement for teaching and learning techniques. Frequent survey for latest references. Encouraging the students in team work cooperation and writing reports.
The extent to which CLOs have been achieved	Independent members of teaching staff	A sample of students answer sheets is revised by a specified committee of the department.
Other		

Assessors (Students, Faculty, Program Leaders, Peer Reviewers, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	CIVIL ENGINEERING COUNCIL
REFERENCE NO.	THE FIFTEENTH SESSION OF THE ACADEMIC YEAR 1446V
DATE	30 APRIL 2025

Course Coordinator



Dr. Mohannad Alyamani