

COURSE CONTENT

Academic Year	2023-2024	Semester	2
Course Coordinator			
Course Code	CV4113		
Course Title	Highway Engineering		
Pre-requisites	CV3014 Transportation Engineering		
No of AUs	3		
Contact Hours	Total: 39 Hours (Lecture: 26 hours; Tutorial: 13 hours)		
Proposal Date	12 September 2023		

Course Aims

This course aims to:

- i) Provide you with the knowledge on the analysis and design and management of flexible and rigid pavements;
- ii) Equip you with the knowledge to apply various types of highway appurtenances to enhance the operations and safety of road users;
- iii) Provide you with the knowledge of the impacts of traffic on transportation such as traffic noise and vehicular tail-pipe emissions, and their control measures.

Course Learning Outcomes (Course LO)

By the end of this course, you should be able to:

1. Analyse and design of flexible and rigid pavements;
2. Propose a Pavement Management System framework;
3. Design highway appurtenances and highway drainage facilities;
4. Design measures to attenuate traffic noise and apply controls of vehicular emissions.

Course Content

S/N	Topic	Lecture Hrs	Tutorial Hrs
1	Design Factors	1	0.5
2	Classification Systems and Properties of Pavement Layers	3	1.5
3	Flexible Pavement Analysis and Design	5	2.5
4	Rigid Pavement Analysis and Design	3	1.5
5	Pavement Management Systems	2	1
6	Environmental Aspects of Transportation	3	1.5
7	Elements of Highway Design	3	1.5
8	Highway Drainage	6	3
Total:		26	13

Assessment

Components	Course LO tested	Related programme SLO or graduate attributes	weighting	Team/ Individual	Assessment rubrics
1. Final Examination	All	EAB SLOs (a), (b), (c)	60%	Individual	
2. Continuous Assessment 1 : Quiz 1	1, 2	EAB SLOs (a), (b), (c)	20%	Individual	
3. Continuous Assessment 2 : Quiz 2	3, 4	EAB SLOs (a), (b), (c)	20%	Individual	
Total			100%		

*CEE SLOs = Student Learning Outcome For Civil Engineering Programme (Per BEng Civil Engineering Accreditation)

Related Programme LO or Graduate Attributes

- a. **Engineering knowledge:** Apply the knowledge of mathematics, natural science, engineering fundamentals, and an engineering specialisation to the solution of complex engineering problems;
- b. **Problem Analysis:** Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences;
- c. **Design/development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
- d. **Investigation:** Conduct investigations of complex problems using research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
- e. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
- f. **The engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

- g. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for the sustainable development.
- h. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- i. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams and in multidisciplinary settings.
- j. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- k. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and economic decision-making, and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- l. **Life-long Learning:** Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

Formative feedback

1. Feedback will be through the dissemination of your performance in quizzes as well as review of the quiz questions in class.
2. We encourage you to initiate an Individual consultation sessions on your particular learning needs.

Learning and Teaching approach

Approach	How does this approach support students in achieving the learning outcomes?
Lectures	Weekly lectures to provide you with the specific knowledge and techniques to achieve the learning outcome stated above.
Tutorials	Weekly tutorials to enable you to apply the knowledge to solve structured problems. We encourage you to explore alternative approaches and techniques.

Textbooks/References:

1. Yoder, E.J. and Witczak, M.W., Principles of Pavement Design. 2nd edition, John Wiley, New York, 1975.

2. 2. Croney, D., Design and Performance of Road Pavements. HMSO, London, 1977.
3. Haas, R. and Hudson, W.R., Pavement Management Systems. McGraw-Hill, New York, 1978.
4. Shell Pavement Design Manual (including the Addendum, 1985). Shell International Petroleum Co Ltd, London, 1978.
5. Calculation of Road Traffic Noise. Department of Transport. Welsh Office, HMSO, London, 1988.
6. O’Flaherty, C.A (ed) Transport Planning and Traffic Engineering. Arnold, London, 1997.
7. Wright, P.H. and Dixon, K.K., Highway Engineering. 7th edition, John Wiley & Sons, New York, 2004.
8. Linsley, R.K., Franzini, J.B., Freyberg D.L. and Tchobanoglous, G., Water Resources Engineering. 4th edition, McGraw-Hill Inc., New York, 1992.

Course Policies and Student Responsibilities

The standing university policy governing student responsibilities shall apply. No special policy for this course.

Academic Integrity

Good academic work depends on honesty and ethical behaviour. The quality of your work as a student relies on adhering to the principles of academic integrity and to the NTU Honour Code, a set of values shared by the whole university community. Truth, Trust and Justice are at the core of NTU’s shared values.

As a student, it is important that you recognize your responsibilities in understanding and applying the principles of academic integrity in all the work you do at NTU. Not knowing what is involved in maintaining academic integrity does not excuse academic dishonesty. You need to actively equip yourself with strategies to avoid all forms of academic dishonesty, including plagiarism, academic fraud, collusion, and cheating. On the use of technological tools (such as Generative AI tools), different courses / assignments have different intended learning outcomes. Students should refer to the specific assignment instructions on their use and requirements and/or consult your instructors on how you can use these tools to help your learning. If you are uncertain of the definitions of any of these terms, you should go to the [Academic Integrity Handbook](#) for more information. Consult your instructor(s) if you need any clarification about the requirements of academic integrity in the course.

Course Instructors

Instructor	Office Location	Phone	Email

Planned Weekly Schedule

Week	Topics	Course LO	Activities
1	Design Factors / Classification Systems	1	Lectures & Tutorial
2	Pavement Layer Properties	1	Lectures & Tutorial
3	Flexible Pavement Analysis and Design	1	Lectures & Tutorial
4	Flexible Pavement Analysis and Design	1	Lectures & Tutorial
5	Flexible Pavement Analysis and Design	1	Lectures & Tutorial
5	Rigid Pavement Analysis and Design	1	Lectures & Tutorial
6	Rigid Pavement Analysis and Design	1	Lectures & Tutorial
7	Pavement Management Systems	2	Lectures & Tutorial
8	Environmental Aspects of Transportation	3	Lectures & Tutorial
9	Environmental Aspects of Transportation	3	Lectures & Tutorial
9	Elements of Highway Design	3	Lectures & Tutorial
10	Elements of Highway Design	3	Lectures & Tutorial
11	Highway Drainage	4	Lectures & Tutorial
12	Highway Drainage	4	Lectures & Tutorial
13	Highway Drainage	4	Lectures & Tutorial