

AI in Built Environment

Course Code CE-312	Credit Hours 2-0
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Course Description

This course explores the transformative impact of AI technologies on the construction industry. This course covers the fundamentals of AI, including machine learning, data analytics, and automation, and their applications in design, construction, and facility management. Students will learn how AI can optimize project planning, improve safety, enhance sustainability, and drive innovation. Through case studies participants will gain experience in leveraging AI tools to address real-world challenges in the built environment, preparing them for the future of smart construction and infrastructure

Text Book:

1. Tarabishy, S., Kosicki, M., & Tsigkari, M. (2021). Artificial Intelligence for the Built Environment. Springer International Publishing.
2. Zhang, L., Pan, Y., Wu, X., & Skibniewski, M. J. (2021). Artificial Intelligence in Construction Engineering and Management. In Lecture Notes in Civil Engineering. Springer Singapore.

Reference Book:

1. Seaton, H. (2020). The construction technology handbook, Wiley
2. Bock, T., & Linner, T. (2015). Robot-Oriented Design. Cambridge University Press.

Prerequisites :

Nil.

Assessment System for Theory

	Without Project (%)	With Project/Complex Engineering Problems (%)
Quizzes	15	10-15
Assignments	10	5-10
Mid Terms	25	25
Project	-	5-10
End Semester Exam	50	45-50

Teaching Plan

Theory:

<u>Week</u>	<u>Topic Covered</u>	<u>Reading Assignment/ Homework</u>	<u>CLO No</u>	<u>Assessment Methodology</u>	
1	Introduction to Information and Communication Technologies:		1	Assignments, Quizzes, MSE, CEP, & ESE	
	<ul style="list-style-type: none"> Components of Information and Communication Technologies (Basics of hardware, software, ICT platforms, networks, local and cloud data storage etc.) 				Assignment 1 Assignment 1 Quiz 1
	<ul style="list-style-type: none"> Scope of Information and Communication Technologies (use of ICT in education, business, governance, healthcare, digital media and entertainment, etc) 	Lecture Notes			
	<ul style="list-style-type: none"> Emerging technologies and future trends. 	Lecture Notes			
	Basics ICT Productivity Tools:				
	<ul style="list-style-type: none"> Effective use of popular search engines (e.g Google, Bing, etc) to explore World Wide Web. 	Lecture Notes			
	<ul style="list-style-type: none"> Formal communication tools and etiquettes (Gmail, Microsoft Outlook, etc) 	Lecture Notes			
	<ul style="list-style-type: none"> Microsoft Office Suites (Word, Excel, PowerPoint) 	Lecture Notes			
	<ul style="list-style-type: none"> Google Workplace (Google Docs, Sheets, Slides). 	Lecture Notes			
	<ul style="list-style-type: none"> Dropbox (Cloud storage and file sharing), Google Drive (Cloud storage with google Docs integration) and Microsoft OneDrive (Cloud storage with Microsoft integration). 	Lecture Notes			
	<ul style="list-style-type: none"> Evernote (Note-taking and organization applications) and OneNote (Microsoft's digital notebook for capturing and organizing ideas). 	Lecture Notes			
	<ul style="list-style-type: none"> Video conferencing (Google Meet, Microsoft Teams, Zoom, etc.) 	Lecture Notes			
	<ul style="list-style-type: none"> Social Media applications (LinkedIn, Facebook, Instagram, etc). 	Lecture Notes			

	ICT in Education:-				
	<ul style="list-style-type: none"> Working with learning management systems (Moodle, Canvas, Google Classrooms, etc) 	Lecture Notes			
	<ul style="list-style-type: none"> Sources of online education course (Coursera, edX, Udemy, Khan Academy, etc) 	Lecture Notes			
	<ul style="list-style-type: none"> Interactive multimedia and virtual classrooms. 	Lecture Notes			
2	Introduction to AI and Machine Learning		Assignment 1 Quiz 1	1	Assignments, Quizzes, MSE, CEP, & ESE
	<ul style="list-style-type: none"> Overview of AI techniques 	Chap 5 (Ref 1)			
	<ul style="list-style-type: none"> Machine learning and their application to the construction industry 	Chap 5 (Ref 1)			
	<ul style="list-style-type: none"> AI agents: Agent function and agent program. 	Lecture Notes			
	<ul style="list-style-type: none"> PEAS Concept: Inputs, Outputs, Processes, Agent Types. 	Lecture Notes			
3 - 4	Construction Data and Analytics			2	
	<ul style="list-style-type: none"> Data collection and analysis techniques 	Chap 6 (Ref 1)	Assignment 2		
	<ul style="list-style-type: none"> Data-driven decision-making 	Chap 6 (Ref 1)	Quiz 2		
	<ul style="list-style-type: none"> Predictive analytics in the construction industry 	Chap 6 (Ref 1)			
5 - 6	Building Information Modeling (BIM) and AI			2	
	<ul style="list-style-type: none"> Overview of BIM and its role in construction 	Chap 2 (Ref 1)			
	<ul style="list-style-type: none"> Introduction to Python programming in BIM 	Chap 2 (Ref 1)	Assignment 3		
	<ul style="list-style-type: none"> Use of AI techniques for processing and analyzing BIM data 	Chap 2 (Ref 1)	Quiz 3		
7 - 8	Machine Learning Concepts Overview			2	
	<ul style="list-style-type: none"> Inputs, Outputs, Processes in AI systems 	Chap 5 (Ref 1)			
	<ul style="list-style-type: none"> Supervised vs. Unsupervised learning and Cost Functions 	Chap 5 (Ref 1)			
	<ul style="list-style-type: none"> Linear Regression, Logistic Regression 	Chap 5 (Ref 1)	Assignment 4		
	<ul style="list-style-type: none"> Bayes Classification, KNN Classification 	Chap 5 (Ref 1)	Quiz 4		
	<ul style="list-style-type: none"> Clustering (K-Means) 	Chap 5			

		(Ref 1)			
	<ul style="list-style-type: none"> Bias and Variance, Learning curves, Error Analysis 	Chap 5 (Ref 1)			
9	Mid Semester Exam				
10-12	Introduction to Neural Networks				2
	<ul style="list-style-type: none"> Developing simple neural networks for construction-related tasks 	Chap 6 (Ref 3)	Assignment 5		
	<ul style="list-style-type: none"> Applications of neural networks in the built environment 	Chap 6 (Ref 3)	Quiz 5		
	<ul style="list-style-type: none"> Computer Vision, Natural Language Processing 	Chap 8 (Ref 3)			
	<ul style="list-style-type: none"> IoT and Robotics in construction 	Chap 8 (Ref 3)			
13-15	Case Studies				3
	<ul style="list-style-type: none"> Intelligent scheduling, resource allocation, and risk management 	Lecture Notes	Assignment 6		
	<ul style="list-style-type: none"> Intelligent transportation system 	Lecture Notes	Quiz 6		
	<ul style="list-style-type: none"> Structural health monitoring 	Lecture Notes			
	<ul style="list-style-type: none"> Open AI in construction 	Lecture Notes			
16	Ethical Considerations and Challenges				3
	<ul style="list-style-type: none"> Understanding bias, privacy, and security in AI systems 	Chap 2 (Ref 1)	CEP (Submission)		
	<ul style="list-style-type: none"> Strategies to address ethical challenges in AI applications 	Chap 2 (Ref 1)			
17-18	End Semester Exam				

Practical: Nil.