NEAR EAST UNIVERSITY – FACULTY OF CIVIL AND ENVIRONMENT ENGINEERING

Department of Civil Engineering
Course Information Sheet & Course Outline

Course Code	**Course Name**	**Credit**	**ECTS**
CIV528/628	Forecasting, Modelling and Statistical Analysis of Atmospheric Data	3	7.5

Pre-requisite:

Language: English | **Course Type:** Elective | **Semester: 2**

Weekly Hours	**Class Hours**	**Laboratory**	**Practicum**	**Learning Sessions**			
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Learning Outcomes	After the completion of this course, the student will be able to ►know how to compute and assess basic statistical properties of a data set ►know how to select and apply appropriate statistical models to infer properties about a population, including estimates of uncertainty, based on a sample of data ►know the strengths and limitations of different methods of analysis commonly applied to geophysical problems ►know how to forecast the weather parameters ►know how to compute correlations and regressions between time series ►know how to deduce the spatial structure of data ►knows how to synthesize and present the results of the analysis in a scientific report
Course Description	This course introduces the physical processes in the atmosphere–heat and energy, temperature, pressure, wind, clouds, precipitation, and stability. These concepts provide the basis for understanding weather systems, such as thunderstorms, tornadoes, and hurricanes. These processes are also applied to climatic patterns and the impacts of human activity on weather and climate, such as air pollution and climate change.
Course Objectives	The course provides a practical guidance in the quantitative analysis of large weather and climate datasets for incorporation into a data analytics system. Also, it provides how to compute descriptive measures and produce figures describing weather and climate datasets; formulate and perform hypothesis testing to determine the significance of a prescribed extreme weather event; visualize, quantify, and model the relationship between observed and forecast variables in applied problems such as weather-marketplace interactions; and demonstrate an appreciation for the role that weather and climate information plays in decision-making processes over a wide range of business and government sectors.
Textbooks and/or References	1 Wallace, J. M., & Hobbs, P. V. (2006). Atmospheric science: an introductory survey (Vol. 92). Elsevier. 2 Wilks, D. S. (2011). Statistical methods in the atmospheric sciences (Vol. 100). Academic press. 3 Wuebbles, D. J. (2012). Introduction to Modern Climate Change. Physics Today, 65(11), 59-59. 4 Oke, T. R., Mills, G., Christen, A., & Voogt, J. A. (2017). Urban climates. Cambridge University Press. 5 Romm, J. J. (2022). Climate change: What everyone needs to know. Oxford University Press.
Course Content	Numerical weather forecasting, climate prediction, data assimilation, verification and ensemble prediction, Physical and mathematical basis of atmospheric data analysis, concepts of statistics, regression, filtering, and principal component analysis.
Methods and Techniques Used in the Course	A combination of lectures, Projects and small group discussions

WEEKLY OUTLINE

Week	Date	Topic	Activities	Reference
1		**Introduction to Classes**		
2			Introduction to Atmospheric Data Analysis • Importance of Atmospheric Data in Various Fields • Overview of Forecasting, Modelling, and Statistical Analysis	
3			Meteorological Fundamentals for Forecasting • Atmospheric Processes and Phenomena • Climate Patterns and Variability • Weather Prediction Models	
4			Data Collection and Measurement Techniques • Instruments for Atmospheric Data Collection • Remote Sensing Technologies • Quality Control in Atmospheric Data	
5			Statistical Methods for Atmospheric Data Analysis • Descriptive Statistics for Meteorological Data • Probability Distributions and Their Applications • Time Series Analysis in Meteorology	
6			Numerical Weather Prediction Models • Introduction to Numerical Weather Prediction (NWP) • Model Components and Parameterization • Evaluation and Validation of NWP Models	
7			Climate Modelling and Simulation • Global Climate Models (GCMs) • Regional Climate Models (RCMs) • Impacts of Climate Change on Atmospheric Data	
8			Architectural Design and Urban Planning • Influence of Climate on Architectural Design • Energy-Efficient Building Design • Urban Heat Island Effect and Mitigation Strategies	
9			**Midterm Exam**	
10			Forecasting Techniques for Various Sectors	

			• Short-Term and Long-Term Forecasting Models • Applications of Atmospheric Forecasting in Urban Planning • Impact of Weather Forecasting on Architectural Design	
11			Case Studies and Practical Applications • Real-world Examples of Successful Atmospheric Data Utilization • Challenges and Solutions in Applying Atmospheric Data to Different Fields • Interdisciplinary Approaches to Atmospheric Data Integration	
12			Emerging Technologies in Atmospheric Data Analysis • Artificial Intelligence and Machine Learning Applications • Internet of Things (IoT) for Enhanced Data Collection • Future Trends and Innovations in Atmospheric Data Analysis	
13			Integrating Atmospheric Insights for Sustainable Development • Recap of Key Concepts • The Role of Atmospheric Data in Shaping Sustainable Practices Across Disciplines	
14			Integrating Atmospheric Insights for Sustainable Development • The Role of Atmospheric Data in Shaping Sustainable Practices Across Disciplines	
15			Ethical Considerations and Responsible Use of Atmospheric Data • Privacy and Security Concerns in Atmospheric Data Collection • Responsible Data Sharing and Collaboration • Ethical Implications in Decision-Making Based on Atmospheric Data	
16			**Final Exams**	

Attendance: Minimum 70 %

Assessment Breakdown		**Type**	**%**	**Reference/Source**	**Relevant Competencies**
	1	Assignments	10		
	2	Project	40		
	3	Midterm Exam	20		
	4	Final Exam	30		