

		National Institute of Technology Meghalaya An Institute of National Importance							CURRICULUM	
Programme		Master of Technology					Year of Regulation		2025	
Department		Civil Engineering					Semester		I	
Course Code	Course Name	Pre-requisite	Credit Structure				Marks Distribution			
			L	T	P	C	INT	MID	END	Total
MA XXX	Statistical Modelling & Simulation	NIL	3	0	0	3	50	50	100	200
Course Objectives	1. To introduce fundamental and advanced statistical techniques applicable to environmental data analysis. 2. To develop simulation models for predicting environmental parameters and processes. 3. To equip students with skills for uncertainty analysis and probabilistic risk assessment. 4. To provide hands-on experience with software tools like R/MATLAB/SPSS for statistical modelling. 5. To enable students to apply statistical methods in real-world environmental engineering problems like air and water quality modeling, hydrological forecasting, etc.		Course Outcomes	CO1	Able to Apply descriptive and inferential statistics to analyze environmental datasets.					
				CO2	Able to Develop and validate simulation models					
				CO3	Able to use statistical software to perform data analytics					
				CO4	Able to interpret uncertainty and sensitivity in environmental modelling.					
				CO5	Able to Design and assess stochastic models for risk analysis and decision-making under uncertainty.					
SYLLABUS										
No.	Content							Hours	COs	
I	Introduction to Statistical Methods: <i>Review of basic statistics:</i> Measures of central tendency, dispersion <i>Probability distributions:</i> Normal, Log-normal, Poisson, Exponential Environmental data types and data transformation techniques							6	CO1, CO2	
II	Inferential Statistics: Sampling techniques & sampling distributions, Estimation & confidence intervals, Hypothesis testing (t-test, chi-square test, ANOVA)							6	CO2, CO3, CO4	
III	Regression and Correlation Analysis: Linear and nonlinear regression, Multiple regression models, Correlation and causality.							5	CO2, CO3, CO4	
IV	Time Series Analysis and Forecasting: Time series components and decomposition, Moving averages, exponential smoothing, ARIMA models and environmental forecasting							7	CO2, CO3, CO4	
V	Stochastic and Monte Carlo Simulation: Concepts of stochastic processes and random variables, Monte Carlo methods and applications, Risk assessment using simulation techniques							9	CO4, CO5	
VI	Modelling with Software: Introduction to R/MATLAB/SPSS/Python, Building and validating simulation models, Hands-on lab sessions and assignments							9	CO4, CO5	
Total Hours								42		
Essential Readings										
1. Acevedo, M.F., Data Analysis and Statistics for Geography, Environmental Science, and Engineering, CRC Press, 2019										
2. Montgomery, D. C., Runger, G.C., Applied Statistics and Probability for Engineers, 2010										
3. Brown, L.C., Berthouex, P. M., Statistics for Environmental Engineers, Lewis Publisher, 2002										
Supplementary Readings										
1. Law, A.M., Simulation Modeling and Analysis, 6 th eds, Mc Graw Hill										
2. Helsel, D.R. and Hirsch, R.M. (USGS) Statistical Methods in Water Resources , 2002										