

**ACADEMIC AFFAIRS OFFICE
INDIAN INSTITUTE OF TECHNOLOGY ROORKEE**

No. Acd./ 365 /IAPC-116

Dated: February 10, 2022

Head, Department of Civil Engineering

The IAPC, in its 116th meeting held on 02.02.2022 vide Item No. 116.2.7, considered and approved the proposal of Department of Civil Engineering to introduce a new PEC i.e., CEN-639: Transportation Data Analysis Techniques for inclusion in M.Tech. curriculum.

The approved syllabus is attached as **Appendix-A**.


Assistant Registrar (Curriculum)

Copy to (through e mail):-

1. All faculty
2. Head of all Departments/ Centres/ School
3. Dean, Academic Affairs
4. Associate Dean of Academic Affairs (Curriculum)
5. Channel i/ AIS (Acad. portal)/ Academic webpage of iitr.ac.in

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: Department of Civil Engineering

1. **Subject Code:** CEN-639 **Course Title:** Transportation Data Analysis Techniques
2. **Contact Hours:** **L:** 3 **T:** 1 **P:** 0
3. **Examination Duration (Hrs.):** **Theory:** 3 **Practical:** 0
4. **Relative Weightage:** **CWS:** 20-35 **PRS:** 0 **MTE:** 20-30 **ETE:** 40-50 **PRE:** 0
5. **Credits:** 4 **6. Semester:** Spring **7. Subject Area:** PEC
8. **Pre-requisite:** Nil
9. **Objective:** To provide the concepts of statistical modelling techniques and its possible applications in modelling transportation data.

10. Details of the Course

S.No.	Contents	Contact hours
1.	Overview of transportation data Transportation data; Data collection sources; Applications of quantitative and qualitative data in transportation studies; Data preparation; Visualization	6
2.	Inferential statistics Descriptive statistics; Hypothesis testing and confidence intervals; Sample size estimation; Statistical tests for comparing sample means and variances; Non-parametric statistics	6
3.	Multivariate distributions in modelling traffic stream parameters Univariate and multivariate distributions; Distribution fitting; Correlation coefficients; Concept of copulas; Families of copulas - Elliptical, Archimedean, and Extreme-value copulas; Joint and Conditional probabilities; Multivariate model development in R and MATLAB; Application of copulas in microscopic traffic flow model development, travel time prediction, travel behavior modelling, driver behavior modelling	8
4.	Statistical techniques in modelling transportation data Applications of regression, non-linear regression, and symbolic regression techniques in traffic studies; Logistic regression models for multinomial and ordinal variables; Reliability analysis; Classification and clustering algorithms in modelling urban traffic patterns, level-of-service; Concepts of neural networks and its applications in driver behavior analysis	8
5.	Modelling user perception data Factor analysis; Concepts of structural equation modelling (SEM); Applications of SEM in evaluating passenger/drivers' perception, satisfaction, and other travel behavior related analysis; Overview of discrete choice models and applications in travel mode choice analysis and other travel behavioral data	6
6.	Interpretation of transportation data using statistical software Transportation case studies - vehicle trajectory analysis, user perception data, transportation mode choice classification; Applications of probability distributions and modeling techniques using statistical software (such as R, SPSS, Minitab, Biogeme); Error metrics for model performance prediction; Interpretation of model output	8
Total		42

11. Suggested Books:

S.No.	Name of Authors/Book/Publisher	Year of Publication / Reprint
1.	Simon Washington, Mathew Karlaftis, Fred Mannering, Panagiotis Anastasopoulos “Statistical and Econometric Methods for Transportation Data Analysis” CRC Press	2020
2.	Matt Wiley, Joshua F. Wiley “Advanced R Statistical Programming and Data Models” Apress	2019
3.	Roger P. Roess, Elena S. Prassas, William R. McShane “Traffic Engineering” 5th Edition, Pearson	2019
4.	Marius Hofert, Ivan Kojadinovic, Martin Mächler, Jun Yan “Elements of Copula Modelling with R” Springer	2018
5.	Harry Joe “Dependence Modelling with Copulas”, CRC Press	2015
6.	Charu C. Aggarwal “Data Classification: Algorithms and Applications” CRC Press	2014
7.	Juan de Dios Ortúzar, Luis G. Willumsen “Modelling Transport” Wiley	2011
8.	Kenneth E. Train “Discrete Choice Methods with Simulation” Cambridge University Press	2009
9.	John C. Loehlin “Latent Variable Models: an introduction to factor, path, and structural equation analysis” Taylor & Francis	2004