Department of Civil Engineering, Indian Institute of Technology, Madras

CE 4720 **–** Computer Applications in Highway and Traffic Engineering, Jul – Nov 2019

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TAs: Siddartha and Rokom

Lecture Hours: H-slot, Mon – 2 to 3:15pm, Tue – 3:25 to 4:40pm

Description: The course focuses on computer applications for traffic engineering, planning, and highway engineering. The course will also provide students with fundamental background in theory, data needs and analysis, models, and interpretation of results.

References:

Washington et al., Scientific Approaches to Transportation Research Volumes 1 and 2,

NCHRP 20-45, 2001, <http://onlinepubs.trb.org/onlinepubs/nchrp/cd-22/start.htm>

Stark, P. B., SticiGui – Online Statistical Textbook,

<http://www.stat.berkeley.edu/~stark/SticiGui/Text/index.htm>

<http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-00-introduction-to-computer-science-and-programming-fall-2008>

List of user manuals/other references will be provided for particular software/topics

Learning Outcomes: This course will enable you to:

* *Understand* data needs for different transportation engineering applications
* *Apply* theoretical concepts to *develop* practical transportation applications
* *Use* programming and software packages for analyzing data and implementing models
* *Interpret* output results from programs and software
* *Present* results using graphical plots and technical reports

Assessment:

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| --- | --- | --- |
| Lab assignments | 20% | Lab assignments will require application of models using programs written by you or software already available. |
| Mini-projects | 20% | Details on the mini-projects are given in the backside. |
| Mid-term | 20% | Lab exam for 20% marks on Sep 24th |
| Final Exam | 40% | Final exam on Nov 16th will have two parts; one lab exam for 20% marks and the other written (covers all the learning outcomes) for 20%. |

List of Broad Topics:

1. Transportation Data Analysis: Basic background in data analysis, statistics, and regression will be covered. Software: Excel, R (for data analysis)
2. Traffic Simulation and Assignment: Fundamental principles of traffic simulation and assignment models; data requirements; Calibration and validation. Software: Write your own code, SUMO / VISSIM.
3. Optimization methods and models in transportation (Python, other open source packages)

General guidelines:

* Institute attendance policy of 85% minimum attendance is required.
* You will work on all assignments independently and on all projects as a team. Discussion within your team on assignments is allowed but final submission must be independent work. Do not copy or submit others assignments as your own!
* Periodic feedback will be sought in class; your active participation is requested in class and during feedback to ensure a better learning environment.

**Mini-projects:** Mini-projects (MP) provide you a more in-depth understanding of a topic.

You may work alone or in teams of two. Choose two mini-project topics related to material covered in class. 1st mini-project initial review: Sep 23, final review: Sep 30. Second mini-project initial review: Nov 4 and final review: Nov 11.

For initial review present 3 slides on problem statement, data availability, and methodology with expected outcomes. For final review prepare a 6 slides presentation and 3-page write-up. The mini-projects need to clearly illustrate the concepts and techniques learned in the course. Weightage would be given to clarity in objective, reasonableness of assumptions, correctness of data, appropriateness of methodology, and quality of power-point presentation and technical writing. There will be a peer-review and grading component to the projects.

Proposed schedule:

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| S. No. | Week of | Topics in class | Assignment / Exams / Reviews |
| Wk 0 | 29th July | Introduction and background test | Assignment 1 given |
| Wk 1 | 5th Aug | Exploratory data analysis; Data visualization |  |
| Wk 2 | 12th Aug | Statistical tests; distributions | Assignment 1 due; Assignment 2 given |
| Wk 3 | 19th Aug |  |
| Wk 4 | 26th Aug | Regression models | Assignment 2 due |
| Wk 5 | 2nd Sep | Advanced econometric applications | Assignment 3 given |
| Wk 6 | 9th Sep | Programming basics |  |
| Wk 7 | 16th Sep | Programming applications | Assignment 3 due; Assignment 4 given |
| Wk 8 | 23rd Sep | Mid-term exam | MP1 initial review |
| Wk 9 | 30th Sep | Simulation of traffic flow | Assignment 4 due; Final review of MP1 |
| Wk 10 | 7th Oct | Optimization basics and application in Traffic Engg | Assignment 5 given |
| Wk 11 | 14th Oct |  |
| Wk 12 | 21st Oct | Assignment 5 due; Assignment 6 given |
| Wk 13 | 28th Oct |  |
| Wk 14 | 4th Nov | Wrap-up | Assignment 6 due; Initial review of MP2 |
|  | 11th Nov |  | Final review of MP2 |
|  | 16-11-2019 | Final Exam |  |