Course Syllabus (updated 1/16/25)
CEE 517 – Traffic Signal Systems
Spring Semester 2025
University of Illinois at Urbana-Champaign
Department of Civil and Environmental Engineering

Course Description: Theory and application of concepts in traffic signal systems control, signal timing design, signal cabinet components, signal controllers, traffic signal theory and control, vehicle detection technologies, signal coordination, signal communication methods, interconnected rail-highway crossing signals, integrated corridor traffic management, and intelligent traffic signal systems. Field trips traffic management centers or similar facilities.

Prerequisite: CEE 416 or consent of Instructor

TOPICAL OUTLINE:

Topics	*Contact Hours*
Introduction	1
Signal timing and design review	3
Traffic Signal Control Components	3
Traffic signal controllers	
Pre-timed controllers	3
Actuated controllers	5
Adaptive controllers	3
Signal progression and coordination	3
Traffic signal theory and control	6
Traffic signal preemption for high priority vehicles	3
Detection technologies	4
Traffic signal systems communication methods	3
Interconnected highway-rail crossing signals	2
Integrated corridor traffic management systems	3
Intelligent traffic control systems	5
Midterm exam (take home)	2
Total	49

REQUIRED TEXTS:

1. *Theory of Highway Traffic Signals*, G. Newell, UCB-ITS-CN-89-1, 1989, (Isolated Intersections (p.1-131) and Coordination in a One-way Arterial (p. 224-361). https://escholarship.org/uc/item/7zn2b9bc

2. Highway Capacity Manual 7th Edition, Chapters 19 and 31

3. Traffic Signal Timing Manual, L. Rodegerdts et al, FHWA-HOP-08-024, 2008, (Ch. 4. Traffic Signal Design Concepts; Ch.5. Basic Signal Timing Procedures and Controller Parameters; Ch. 6. Coordination and Ch. 9. Advanced Signal Timing Concepts). (http://ops.fhwa.dot.gov/publications/fhwahop08024)

4. Signal Timing Manual, Second Edition, NCHRP 812, Tom Urbanik et al, TRB 2015. http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_812.pdf (Ch. 4. Signal Design;

Ch.5. Intro to Timing Plans; Ch. 6. Uncoordinated Timing: Ch7: Coordinated Timing; and Ch. 9. Advanced Signal Timing.

5. *Traffic Engineering*, Fifth Ed. Roess, et al. Prentice-Hall, 2019 (Ch. 21-. Signal Coordination for Arterials and Networks)

6. *Traffic Detector Handbook*, Third Ed Vol. I, L.A. Klein et al, FHWA-HRT-06-108, 2006, (Ch. 1. Introduction; Ch. 2. Technology; Ch. 4. In-roadway Sensor Design), http://www.fhwa.dot.gov/publications/research/operations/its/06108/06108.pdf

7. Class notes, journal articles, manuals for software and hardware given in class

    a. Benekohal, R. F., El-Zohairy, Y., "Multi-Regime Arrival Rate Uniform Delay Models for Signalized Intersections: Part I- Model Development, Part II Validation and sensitivity Analysis," J. of Transportation Research, Part A, Vol. 35, No 7, P625-667, August 2001.
    b. Benekohal, R. F., El-Zohairy, Y," Progression Adjustment Factors for Uniform Delay at Signalized Intersections," J. of Transportation Research Board, No. 1678, p 32-41, NRC, 1999

RECOMMENDED TEXTS:

8. *Traffic Control Devices Handbook*, 2nd Edition 2013, (Ch. 10 Traffic Signals)

9. *Traffic Control Systems Handbook*, R. Gordon and W. Tighe, FHWA-HOP-06-006, 2006. (Ch. 7. Local Controllers; Ch. 3. Control Concepts – Urban and Suburban Streets) (http://ops.fhwa.dot.gov/publications/fhwahop06006/index.htm)

GRADING:

Homework and class participation 20%,
Class project 25%,
Midterm Exam 25%,
Final Exam 30%

Midterm Exam: Take home exam on Thursday March 27 (due in 24 hours)

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