Traffic Engineering & Management - Web course

COURSE OUTLINE

Traffic engineering and management is a first level post graduate course in Transportation Systems Engineering.
The course introduces the concepts of characterizing traffic, various modeling approaches, and design of facilities to control and manage traffic.
The course is designed in a modular fashion so that each module will introduce the underlying principles, current practice, ample numerical illustrations, and few case studies of broad areas of the subject.
The modules are sequenced in such a way that the course first introduces simple, but fundamental characteristics of traffic and move gradually to complex traffic management concepts.
The last module is devoted for advanced and specialized traffic facilities. Although the major focus of the course is urban vehicular traffic, some effort is taken to show how these lessons can be applied to other modes as well.
A key feature of the course is that it is well knit with the current design and analysis practice stipulated in both national and international codes, standards, and manuals.
Contents:

Traffic stream characteristics; Traffic measurement procedures; Microscopic traffic flow modeling; Macroscopic and mesoscopic traffic flow modeling; Uninterrupted flow; Traffic intersection control; and Traffic impact studies.

COURSE DETAIL

Sl. No.	Topics	No. of Hours
1.	**Traffic stream characteristics:** ***Introduction to traffic engineering***: Road user characteristics, human and vehicle characteristics; ***Fundamental parameters and relations of traffic flow***: speed, density, volume, travel time, headway, spacing, time-space diagram, time mean speed, space mean speed and their relation, relation between speeds, flow, density, fundamental diagrams; ***Traffic stream models***: Greenshield's model, Greenberg's logarithmic model, Underwood's exponential model, pipe's generalized model, multi-regime models; ***Moving observer method***: Concepts and derivation, illustration, Calibration of Greenshild's model.	04
2.	**Traffic measurement procedures:** ***Measurement at a point:*** Traffic volume measurement, equipment for flow measurements, data analysis, concepts of ADT, AADT; ***Measurement over a short section***: Speed measurements, 15th and 85th percentile speeds, design speed, speed distributions; ***Measurement along a length of road:*** Density measurement, travel time measurement; ***Automated traffic measurement:*** GPS devices, loop detectors, video analysis, and other technologies.	04
3.	**Microscopic traffic flow modelling:** ***Car-following models:*** Concept of stimulus-response, general mottoes models, safety distance, pscho-physical, optimal velocity, fuzzy logic models, and applications; ***Lane changing models:*** Conceptual framework, lane selection model, gap acceptance models;	04

NP-TEL

NPTEL

http://nptel.ac.in

Civil Engineering

Pre-requisites:

1. Transportation Engineering I (B. Tech).
2. Transportation Engineering II (B. Tech).

Additional Reading:

1. FHWA Geometric design guides.
2. Transportation research records.
3. Indian Roads congress special publications.

Hyperlinks:

1. Traffic-Flow Theory: State-of-the-art: http://www.tfhrc.gov/its/tft/tft.htm.
2. Manual on Uniform Traffic Control Devices http://mutcd.fhwa.dot.gov/.

Coordinators:

Dr. Tom V Mathew
Department of Civil EngineeringIIT Bombay

	Vehicle arrival models: Poisson distribution, headway modeling, random vehicle generation; ***Microscopic traffic simulation***: Vehicle generation, design, calibration, validation, applications, operational models.	
4.	**Macroscopic and mesoscopic traffic flow modelling:** ***Traffic flow modeling analogies:*** Fluid flow analogy, heat flow analogy, granular flow, Lighthill-Withams theory, shock waves; ***Cell transmission models***: Flow conservation, flow transmission; ***Traffic progression models***: Robertson progression model, platoon movement, dispersion index, applications; ***Discrete simulation models***: Cellular automata concepts, discretization of time and space, rules for acceleration, deceleration, randomization, and vehicle updation.	04
5.	**Uninterrupted flow:** ***Capacity and Level of service LOS:*** Definitions, highway capacity, factors affecting LOS, HCM methods; ***Urban Street:*** Classification, operational performance measures, congestion management; ***Multilane highways:*** Characteristics, capacity and level of service; ***Freeway operations:*** Operational considerations, capacity and level of service of a basic freeway segment, weaving operation; ***Ramp metering:*** Merging and diverging areas; gap acceptance, speed at ramps; fixed, reactive, and predictive systems; ***Corridor analysis:*** Segment capacity, free flow travel time, queue delay, transit corridor.	06
6.	**Traffic intersection control:** ***Principles of traffic control:*** Requirements, basic driving rules, priority movements, principles of traffic control, intersections conflicts; ***Traffic signs and road markings:*** Regulatory, warning, and information signs; longitudinal, transverse, and object marking; ***Uncontrolled intersection:*** Level of service concept, priority streams, confliting traffic, critical gap and follow-up time, capacity, queue length, control delay; ***Channelization:*** *channelizing* devices, geometrical aspects, turning radius ; ***Traffic rotary:*** Conflict resolution in a rotary, geometric layout, design elements, capacity of rotary; ***Grade separated intersection:*** Road over bridges, under pass, overpass, trumpet interchange, diamond interchange, fully and partial clover leaf intersection.	06
7.	**Traffic signal design:** ***Elements of traffic signal:*** Definitions, analysis of saturation headway, saturation flow, lost time, critical flows, derivation of cycle length; ***Design principles of a traffic signal***: Phase design, cycle time determination, green splitting, pedestrian phases, and performance measures; ***Evaluation of a traffic signal:*** Definitions and measurement of stopped and control delay, Webster's delay model, oversaturated conditions; ***Capacity and Los analysis of a signalized I/S:*** HCM 2000 method of analysis of a signalized intersection and determination of the level of service; ***Coordinated traffic signal:*** Concepts of offset, common cycle length bandwidth, offset for one-way and two way streets ; ***Vehicle actuated signals and Area traffic control***: Basic principles of vehicle actuation, collection of data, system architecture and algorithms.	06
8.	**Specialised traffic studies:** ***Parking Studies:*** Parking inventory, statistics, parking surveys; in-out, license palate, on-street and off-street parking ; ***Accident Studies***: Accident data collection, statistics, safety audit, sfety measures;	07

	Fuel consumption and emission studies: Consumption models, pollutants, air quality models, mitigation measures; ***Congestion studies***: Performance measures, intensity, duration, extent of congestion, traveler perception, remedial measures, congestion pricing; ***Toll operation:*** Design and configuration, queuing theory, operation and maintenance issues; ***Pedestrian studies:*** Pedestrian counts, pedestrian volume and level of service, design principles of pedestrian facilities;	
9.	**Intelligent Transportation System:** ***Intelligent Transportation System – I*** ***Intelligent Transportation System – II*** ***Advanced ITS***	03

References:

1. Roess, RP., McShane, WR. and Prassas, ES. (1998), Traffic Engineering, Prentice Hall.
2. May, A. D. (1990), Fundamentals of Traffic Flow, Prentice Hall.
3. Papacostas, C. S. (1987), Fundamentals of Transportation Engineering, Prentice Hall.
4. Kadiyali, LR (1987), Traffic Engineering and Transportation Planning, Khanna.
5. Highway Capacity Manual (2000), Transportation Research Board, USA.
6. Khanna, S. K. and Justo, C. E. G. (1991), Highway Engineering, Nemchand.
7. Pingnataro, G. J. (1970), Principles of Traffic Engineering, Mc Graw - Hill.