

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**CIVIL (TRANSPORTATION ENGINEERING) (13)**  
**TRAFFIC FLOW THEORIES AND SIMULATION**  
**SUBJECT CODE: 2731306**  
**M.E. 3<sup>RD</sup> SEMESTER**

**Type of course:** Major Elective - IV

**Prerequisite:** Traffic Engineering

**Rationale:** Increased vehicular ownership has created problems of congestion, pollution and accidents on urban road network acutely. Hence, it is necessary for the Traffic Engineer to understand behavior of traffic flow, its characteristics, theories developed to prepare its model and its quantification. These theories are also useful to develop the traffic simulation models. The actions for traffic control and measures for mitigating the impacts can be implemented effectively after studying the simulation of traffic conditions. Therefore, it is essential for the Traffic Engineer to know about the procedure of traffic simulation. This course includes various traffic flow theories and procedures for developing traffic simulation models.

**Teaching and Examination Scheme:**

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P		Theory Marks		Practical Marks				
			ESE (E)	PA (M)	ESE (V)		PA (I)			
					ESE	OEP	PA	RP		
3	2#	2	5	70	30	20	10	10	10	150

**Content:**

Sr. No.	Content	Total Hrs	% Weightage
1	<b>Traffic Stream Characteristics:</b> Measurement, microscopic and macroscopic study of traffic stream characteristics - flow, speed and concentration; use of counting, interval and translated distributions for describing vehicle arrivals, headways, speeds, gaps and lags; fitting of distributions, goodness of fit tests, gap acceptance	8	18
2	<b>Traffic Stream Models:</b> Fundamental equation of traffic flow, speed-flow-concentration relationships, normalised relationship, fluid flow analogy approach, shock wave theory, platoon diffusion and Boltzmann like behaviour of traffic flow, car-following theory, linear and non-linear car-following models, acceleration noise	10	25
3	<b>Queuing Analysis:</b> Fundamentals of queuing theory, demand service characteristics, deterministic queuing models, stochastic queuing models, multiple service channels, models of delay at intersections and pedestrian crossings.	7	16
4	<b>Highway Capacity &amp; Level-of-Service Studies:</b> Concepts, factors affecting capacity & level-of service, capacity analysis of different highway facilities, passenger car units, problems in mixed traffic flow.	7	16

<b>5</b>	<b>Traffic Simulation:</b> System simulation, simulation languages, generation of random numbers, generation of inputs – vehicle arrivals, vehicle characteristics, road geometrics, design of computer simulation experiments.	<b>10</b>	<b>25</b>
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### Reference Books:

1. TRB - SR No.165 - Traffic Flow Theory, Transportation Research Board, Washington - D.C.
2. May, A D., Traffic Flow Fundamentals, Prentice-Hall, NJ
3. Drew, D.R., Traffic Flow Theory and Control, McGraw-Hill, New York.
4. TRB Special Report 209: Highway Capacity Manual, Transportation Research Board, Washington DC, 1985.
5. Wohl M. and Martin, B V., Traffic System Analysis for Engineers and Planners, McGraw-Hill, New York.
6. McShane W R & Roess R P, Traffic Engineering, Prentice-Hall, NJ, 1990.
7. Neylor, T.H. et al., Computer Simulation Techniques, John Wiley.
8. Highway Capacity Manual, Transportation Research Board, Washington DC, 2000, 2010.

### Course Outcome:

After learning the course the students should be able:

1. To know in details about the traffic flow theories and its simulation procedure.
2. To be familiar with analysis of traffic stream using different traffic flow models.
3. To be conversant with computer simulation for generating the traffic flow conditions, which may be useful for dissertation work and for evaluation of traffic improvement measures.

### List of Experiments:

1. Classified traffic volume count along with spot speed data on congested urban road mid-block section (Preferably using video-graphy).
2. Generation of speed-flow-density relationship from the collected data.
3. Statistical analysis of the collected data for the parameters like - vehicle arrival pattern, headway, speed, gap, overtaking, queuing etc.
4. Intersection volume count and delay measurements.
5. Pedestrians flow measurement and their crossing behavior analysis.
6. Data collection for determining highway capacity and level of service.
7. Computer simulation of observed traffic data, using programme or software.
8. Simulation experiments for improving the traffic conditions.

### Design based Problems (DP)/Open Ended Problem:

Below mentioned problems are for reference only. Similar problems may be developed by individual teachers.

1. Simulation of overtaking behavior on urban arterial
2. Simulation of effect on traffic stream by introducing bump/speed breaker
3. Simulation of pedestrian crossing - with and without pedestrian signals
4. Simulation of uncontrolled and signalized intersection
5. Simulation of pre-timed versus actuated signalized intersection
5. Simulation of coordination of signals on urban corridor

### Major Equipment:

Video Camera

**List of Open Source Software/learning website:**

VISSIM, VISUM - Academic version for the students

**Review Presentation (RP):** The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website.