

**GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)**

**Competency-focused Outcome-based Green Curriculum-2021 (COGC-2021)  
Semester-VI**

**Course Title: Traffic Engineering  
(Course Code: 4360606)**

<b>Diploma programme in which this course is offered</b>	<b>Semester in which offered</b>
Civil Engineering	6 <sup>th</sup> Semester

**1. RATIONALE**

Traffic engineering is a branch of civil engineering that uses engineering techniques to achieve the safe and efficient movement of people and goods on roadways. Knowledge and understanding of the basic concept of traffic Engineering is highly essential for the engineers designing and executing the road laying projects in order to make road. Traffic engineering plays a pivotal role in all facets of transportation, and given the ever-expanding population and infrastructure developments. This includes the planning and implementation of traffic control elements such as traffic sings, signals, and road markings to enhance safety for both drivers and pedestrians. The course aims to cultivate expertise in conducting diverse traffic surveys, deciphering and making sense of the collected data, and proposing solutions in the form of traffic control devices. At diploma level, students are expected to perform various traffic surveys, analyse traffic data and interpret the results appropriately in order to apply their knowledge in designing good road transport systems.

**2. COMPETENCY**

The purpose of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Execute the working and control of traffic engineering elements.**
- **Determine traffic requirements for road design after conducting the traffic surveys.**

**3. COURSE OUTCOMES (COs)**

The practical exercises, the underpinning knowledge and the relevant soft skills associated with this competency are to be developed in the student to display the following COs:

- a) Analyze the road traffic characteristics.
- b) Undertake various types of road traffic studies.
- c) Use the relevant road traffic control devices.
- d) Interpret traffic management system.

- e) Suggest preventive measures to avoid accidents by analyzing the traffic conditions at site and maintain the road environment.
- f) Aware about advanced technology in traffic engineering.

**4. TEACHING AND EXAMINATION SCHEME**

Teaching Scheme (In Hours)			Total Credits (L+T/2+P/2)	Examination Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			C	CA	ESE	CA	ESE	
3	-	2	4	30*	70	25	25	150

(\*):Out of 30 marks under the theory CA, 10 marks are for assessment of the micro-project to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessing the attainment of the cognitive domain UOs required for the attainment of the COs.

**Legends:** L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P -Practical; C – Credit, CA - Continuous Assessment; ESE -End Semester Examination.

**5. SUGGESTED PRACTICAL EXERCISES**

The following practical outcomes (PrOs) are the sub-components of the COs. Some of the PrOs marked '\*' are compulsory, as they are crucial for that particular CO at the 'Precision Level' of Dave's Taxonomy related to 'Psychomotor Domain'.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Identify the road traffic characteristics for any existing road.	I	02*
2	Perform traffic volume study at intersection.	II	04*
3	Carry out O-D Survey within area of your town/city.	II	04*
4	Calculate at least eight examples based on spot speed study and signal cycle time.	II, IV	02*
5	Measure the spot speed on corridor of road way to analyze the percentile speed graphically.	II	02
6	Prepare a report of a field visit to any major road intersection in your locality to identify the type, working of traffic signals along with your recommendations if any.	III	02

7	Suggest the relevant vehicle parking system for your campus along with your recommendations in the form of a report.	II	02*
8	Prepare sketches for Traffic Sign-Regulatory, Warning and Informatory sign.	III	02*
9	Prepare sketches for Road marking - Pavement marking, Kerb marking, Object Marking and Reflector marking.	IV	02*
10	Prepare a report of a field visit to any urban road way to identify the road signs, corresponding markings on road, traffic island, road intersection and existing street lighting system.	IV, V	04*
11	Draw the collision diagram for any case study of road accident. Locate the points of conflicts in the diagram of a busy intersection on a road in your locality.	V	02*
12	Seminar	-	04*
<b>Total</b>			<b>28</b>

**Note**

- i. More **Practical Exercises** can be designed and offered by the respective course teacher to develop the industry relevant skills/outcomes to match the COs. The above table is only a suggestive list.
- ii. The following are some **sample** ‘Process’ and ‘Product’ related skills (more may be added/deleted depending on the course) that occur in the above listed **Practical Exercises** of this course required which are embedded in the COs and ultimately the competency.

S. No.	Sample Performance Indicators for the PrOs	Weightage in %
<b>For PrOs 8,9,11</b>		
1	Prepare drawing/sketches	40
2	Neatness, accuracy in work and drawings.	20
3	Notation in the given drawing and writing text.	20
4	Answer the questions.	10
5	Submission of drawing in time	10
<b>Total</b>		<b>100</b>

S. No.	Sample Performance Indicators for the PrOs	Weightage in %
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<b>For PrOs 4</b>		
1	Calculate numerical based on given data.	40
2	Accuracy in calculation.	30
3	Answer the questions	20
4	Submission of example in time.	10
<b>Total</b>		<b>100</b>

<b>S. No.</b>	<b>Sample Performance Indicators for the PrOs</b>	<b>Weightage in %</b>
<b>For PrOs1, 2, 3, 5,6,7,10</b>		
1	Participation in site visit/perform survey	30
2	Data collection during site visit/survey	20
3	Technical involvement during site visit/survey	20
4	Preparation and submission of report/survey data	20
5	Timely submission of report	10
<b>Total</b>		<b>100</b>

<b>S. No.</b>	<b>Sample Performance Indicators for the PrOs</b>	<b>Weightage in %</b>
<b>For PrOs 12</b>		
1	Initiative, topic selection	20
2	Data Collection, preparation of presentation	30
3	Content of Presentation (Use of multi media)	20
4	Presentation (Body Language- Gesture, Posture etc.)	20
5	Answer the question	10
<b>Total</b>		<b>100</b>

**6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED**

These major equipments with broad specifications for the PrOs is a guide to procure them by the administrators to usher in uniformity of practical in all institutions across the state.

S. No.	Equipment Name with Broad Specifications	PrO.No.
1	Computer system - with basic configuration	-

**7. AFFECTIVE DOMAIN OUTCOMES**

The following *sample* Affective Domain Outcomes (ADOs) are embedded in many of the above mentioned Cos and PrOs. More could be added to fulfil the development of this competency.

- a) Work as a leader/a team member.
- b) Follow safe practice on site.
- c) Follow ethical practices.
- d) Practice environmental friendly methods and processes. (Environment related)

The ADOs are best developed through the laboratory/field based exercises. Moreover, the level of achievement of the ADOs according to Krathwohl’s ‘Affective Domain Taxonomy’ should gradually increase as planned below:

- i. ‘Valuing Level’ in 1<sup>st</sup> year
- ii. ‘Organization Level’ in 2<sup>nd</sup> year.
- iii. ‘Characterization Level’ in 3<sup>rd</sup> year.

**8. UNDERPINNING THEORY**

Only the major Underpinning Theory is formulated as higher level UOs of *Revised Bloom’s taxonomy* in order development of the COs and competency is not missed out by the students and teachers. If required, more such higher level UOs could be included by the course teacher to focus on attainment of COs and competency.

Unit	Unit Outcomes (UOs)	Topics and Sub-topics
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<p><b>Unit – I Fundamental of Traffic Engineering</b></p>	<p>1a Describe the characteristics of road users in the given situation.</p> <p>1b Describe the vehicular characteristics for the given situation.</p> <p>1c Calculate reaction time of driver in the given situation.</p> <p>1d Explain the factors affecting the reaction time for the given situation.</p>	<p>1.1 Traffic engineering- Definition, objects, scope</p> <p>1.2 Road user's characteristics physical, mental, emotional factors.</p> <p>1.3 Vehicular characteristics-width, length, height, weight, speed, efficiency of breaks.</p> <p>1.4 Road characteristics-gradient, curve of a road, design speed, friction between road and tyre surface.</p> <p>1.5 Reaction time-factors affecting reaction time. PIEV Theory.</p>
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Unit	Unit Outcomes (UOs)	Topics and Sub-topics
<p><b>Unit - II Traffic Studies</b></p>	<p>2a Measure the traffic volume for the given section of road.</p> <p>2b Analyze Traffic volume count data collected for the given road.</p> <p>2c Analyze spot speed study data collected for the given road.</p> <p>2d Design, develop and suggest the improvement for the parking system at the given situation.</p>	<p>2.1 Traffic Studies-types, purpose, Information required for traffic studies.</p> <p>2.2 Traffic volume study- definition, purpose, Methods of collection of traffic volume count data (manual, automatic recorders, moving car method), representation and analysis of traffic data.</p> <p>2.3 Necessity of Origin and Destination study and its methods.</p> <p>2.4 Speed studies-spot speed studies, and its presentation</p> <p>2.5 Need and method of parking study.</p>

<b>Unit– III Traffic Control Devices</b>	3a Classify traffic control devices. 3b Interpret traffic Signs. 3c Design traffic signals for given intersection of road. 3d Classification of road marking	3.1 Importance and general principal of traffic control devices. 3.2 Different types of traffic sign as per IRC recommendation. 3.3 Traffic Signals – Types of traffic signals with merit and demerits, phasing of traffic signals. 3.4 Design of signal cycle time by Fix time cycle, IRC method, Approximate method, Webster’s method. 3.5 Road marking - Pavement marking, Kerb marking, Object Marking, Reflector marking.
<b>Unit – IV Traffic Management</b>	4a Describe Traffic management policy and measures. 4b Discuss street furniture. 4c Explain traffic regulations and traffic Geometrics.	4.1 Basic principles of traffic management. 4.2 Street furniture types - Roadway delineators, Hazard marker, Object marker, Speed breaker, Rumble strips, Guard Rails, Safety Barriers, Traffic Attenuators, Barricades and channelizes 4.3 Traffic Regulations - Basic principle, Scope, Traffic lows. 4.4 Traffic Geometrics - Intersection at grade, Interchange, Traffic Island, Terminal Facilities.
<b>Unit</b>	<b>Unit Outcomes (UOs)</b>	<b>Topics and Sub-topics</b>

<p><b>Unit – V Road Accident and Environment</b></p>	<p>5a Analyze the causes of accident occurred and Suggest preventive measures to avoid the accidents on the given road section.                      5b Create awareness about the traffic rules and laws at selected location.                      5c Suggest the street lighting system for the given road section.                      5d Recommend the relevant type of trees for road side plantation.                      5e Justify the need of protecting the road side plantation.                      Describe the methods of protecting the road side plantation.</p>	<p>5.1 Road accidents-Definition, types (Collision and non-collision accidents), Causes, Prevention of road accidents.                      5.2 Reporting and recording of an accident.                      5.3 Collision and condition diagram.                      5.4 Considerations regarding road safety.                      5.5 Legislation and law enforcement education and propaganda.                      5.6 Street lighting-definition, sources necessity, types-luminaire, foot candle, lumen, factors affecting their utilization and maintenance.                      5.7 Factors affecting visibility at night.                      5.8 Arboriculture- definition, objectives, factors affecting selection of type of trees.                      5.9 Maintenance of trees-protection and care of road side trees.</p>
<p><b>Unit – VI Advancement in Traffic Engineering</b></p>	<p>6a Discuss the role of information technology in improving traffic system. Know technology used in traffic management system.                      6b Discuss future of traffic management                      6c</p>	<p>6.1 Brief overview of Highway Traffic Management System (HTMS), Intelligent Transportation System (ITS).                      6.2 Smart Traffic Management System (STMS) – Objective, Benefits.                      6.3 Brief overview of technology used in traffic management system - IoT sensor.</p>

**Note:** The UOs need to be formulated at the ‘Application Level’ and above of Revised Bloom’s Taxonomy’ to accelerate the attainment of the COs and the competency.

**9. SUGGESTED SPECIFICATION TABLE FOR QUESTIONPAPER DESIGN**

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Fundamentals of Traffic Engineering	04	04	-	-	04
II	Traffic Studies	08	02	04	08	14



III	Traffic Control Devices	10	04	08	06	18
IV	Traffic Management	10	04	06	08	18
V	Road Accident and Environment	06	02	06	04	12
VI	Advancements in Traffic Engineering	04	04	-	-	04
Total		<b>42</b>	<b>20</b>	<b>24</b>	<b>26</b>	<b>70</b>

**Legends:** R=Remember, U=Understand, A=Apply and above (Revised Bloom's taxonomy)

**Note:** This specification table provides general guidelines to assist student for their learning and to teachers to teach and question paper designers/setters to formulate test items/questions assess the attainment of the UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary slightly from above table.

## 10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested studentrelated **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- a) Prepare journals based on practical performed in laboratory.
- b) Group discussion on traffic jams and related probable solutions in the city.
- c) Undertake micro-projects.

## 11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- a) Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- b) Guide student(s) in undertaking micro-projects.
- c) **'L' in section No. 4** means different types of teaching methods that are to be employed by teachers to develop the outcomes.
- d) About **20% of the topics/sub-topics** which are relatively simpler or descriptive in nature is to be given to the students for **self-learning**, but to be assessed using different assessment methods.
- e) With respect to **section No.11**, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- f) Guide students on how to address issues on environ and sustainability.

## 12. SUGGESTED MICRO-PROJECTS

**Only one micro-project** is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-projects are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshopbased, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs. A suggestive list of micro-projects is given here. This has to match the competency and the COs. Similar micro-projects could be added by the concerned course teacher:

- a) Prepare a model of traffic controlling devices.
- b) Make posters showing traffic safety and awareness.
- c) Prepare the charts showing different types of road signs.
- d) Measure the spot speed on corridor of road way to analyze the percentile speed graphically.
- e) Prepare a report of a field visit to any major road intersection in your locality to identify the type, working of traffic signals along with your recommendations.
- f) Prepare a report of a field visit to any urban road way to identify the road signs and corresponding markings on road.
- g) Prepare a report on advanced road marking machinery and materials.
- h) Perform traffic survey of busy road junction of city in groups and to suggest measures for improvement.
- i) Prepare a report of a field visit to any urban road to identify the traffic island along with its sketch.
- j) Undertake the process of planting, protecting and maintaining the trees along the road.
- k) Identify the existing street lighting system of any two types of roads.
- l) Locate the points of conflicts in the diagram of a busy intersection on a major urban road in your locality.
- m) Identify the existing type of trees to suggest any relevant maintenance required.

## 13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication with place, year and ISBN

1	Transportation Engineering	Arora, N. L.,	Khanna Publishers, Delhi, 1996.ISBN: 817319-0933.
2	Traffic Engineering and Transport Planning	Kadiyali, L.R.	Khanna Publishers, Delhi, 2001,ISBN:10: 8185240779:
3	Transportation Engineering Vol. I & II	Vazirani, VN Chaondola, SP	Khanna Publishers. Delhi, 2016 ISBN: 9780128038185; 9780128038895
4	Traffic planning and design	Saxsena. SC	Dhanpat Rai & Sons Delhi. 2016 ISBN-10: 8123913500
5	Indian Highways- IRC Journal	Journalmonthly issue	IRC (Indian Road Congress), India, 1973, ISSN: 0376-7256
6	IRC:67-2022,IRC:SP:552014, IRC:SP-044, IRC:53-2012	IRC	--

**14. SOFTWARE/LEARNING WEBSITES**

1. <https://nptel.ac.in>
2. [https://www.mhi.com/products/transport/intelligent\\_transport\\_system\\_htms.html](https://www.mhi.com/products/transport/intelligent_transport_system_htms.html)
3. [https://morth.nic.in/sites/default/files/Finalized\\_Draft\\_AIS\\_140\\_regarding\\_Intelligent\\_Transportation\\_Systems\\_.pdf](https://morth.nic.in/sites/default/files/Finalized_Draft_AIS_140_regarding_Intelligent_Transportation_Systems_.pdf)
4. <https://indiaai.gov.in/article/role-of-iot-in-road-safety-and-traffic-management>
5. <https://your.visum.ptvgroup.com/vision-traffic-suite-students-en>

**15. PO-COMPETENCY-CO MAPPING**

Semester V		Traffic Engineering (Course Code: )									
		POs and PSOs									
Competency & Course Outcomes		PO 1 Basic & Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/ development of solutions	PO 4 Engineering Tools, Experimentation & Testing	PO 5 Engineering practices for society, sustainability & environment	PO 6 Project Management	PO 7 Lifelong learning	PSO 1	PSO 2	PSO 3 (if needed)
<b>Competency</b>		<ul style="list-style-type: none"> <li>Execute the working and control of traffic engineering elements.</li> <li>Determine traffic requirements for road design after conducting the traffic surveys.</li> </ul>									
COa)	Analyze the road traffic characteristics.	3	-	-	-	2	2	3			

COb)	Undertake various types of road traffic studies.	3	3	2	2	3	3	3			
COc)	Use the relevant road traffic control devices.	3	2	2	3	3	2	3			
COd)	Interpret traffic management system	3	2	-	2	3	3	3			
COe)	Suggest preventive measures to avoid accidents by analyzing the traffic conditions at site and maintain the road environment.	3	2	-	3	2	2	3			
COf)	Aware about advanced technology in traffic engineering.	2	2	2	2	2	2	3			

Legend: '3' for high, '2' for medium, '1' for low or '-' for the relevant correlation of each competency, CO, with PO/ PSO

## 16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

### GTU Resource Persons

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