

**Program Name** : Civil Engineering Program Group  
**Program Code** : CE/CR/CS  
**Semester** : Fifth  
**Course Title** : Traffic Engineering (Elective)  
**Course Code** : 22507

### 1. RATIONALE

Traffic engineering is an important aspect of all modes of transportation. Due to the abundant growth in population and infrastructure development, there is urgent need to pay the immediate attention to the certain issues like designing traffic control device installations and modifications, including traffic signals, signs, and pavement markings. Also it is important for safety of vehicle users as well as pedestrians. This course is expected to develop knowledge of performing various traffic surveys, analyze and interpret the data and provide the solutions in the form of traffic controlling devices. The civil engineering diploma holders have to do the related construction and maintenance activities of the structures made for guiding the traffic.

### 2. COMPETENCY

The aim 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.**

### 3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Analyze the road traffic characteristics.
- Undertake various types of road traffic studies.
- Use the relevant road traffic signs and markings.
- Select the relevant road signals for the given traffic islands
- Maintain the road environment.
- Suggest preventive measures to avoid accidents by analyzing the traffic conditions at site.

### 4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
Max	Min	Max	Min		Max	Min	Max	Min	Max	Min	Max	Min	Max	Min		
3	=	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20

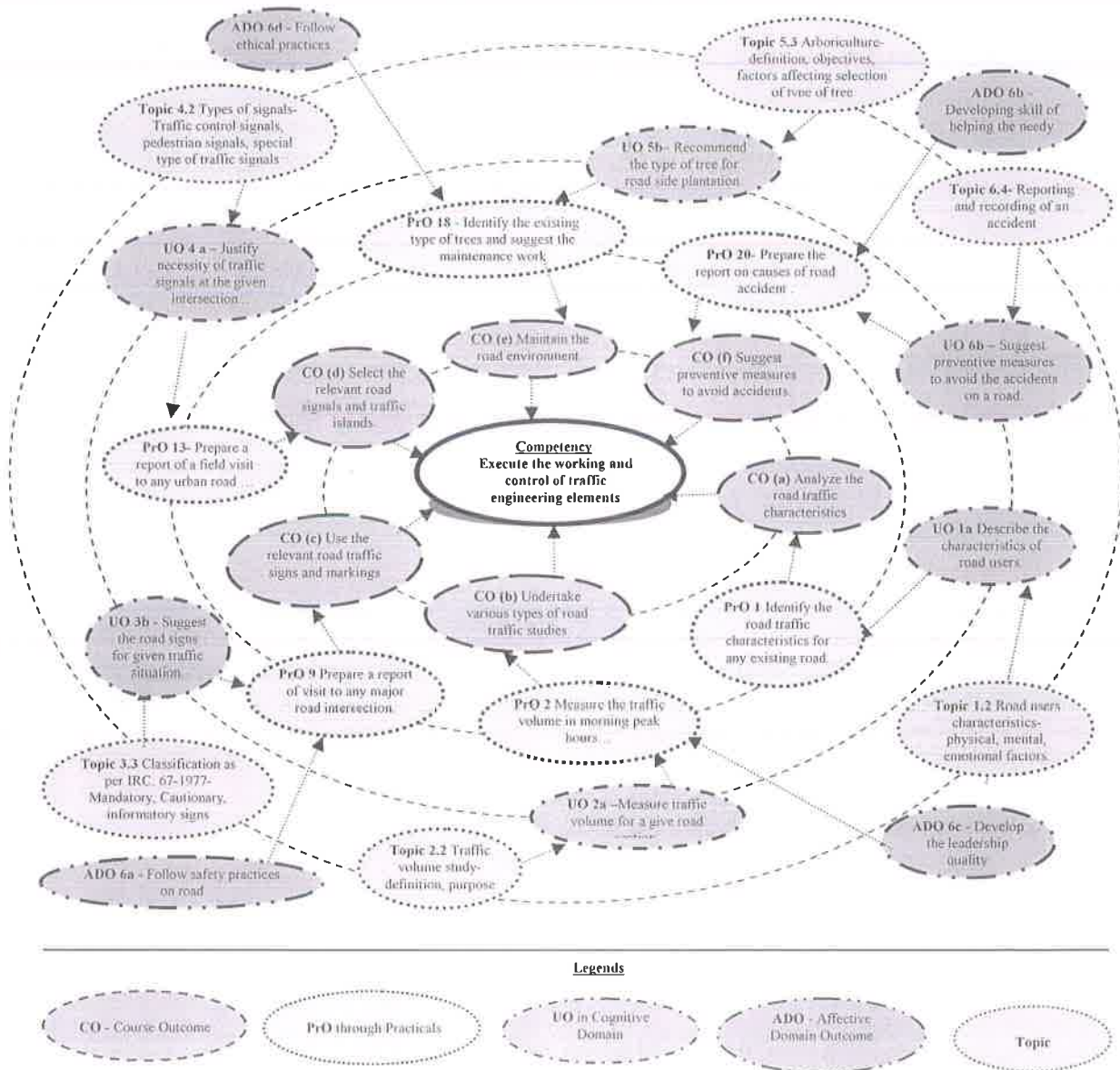
(\*): Under the theory PA; Out of 30 marks, 10 marks of theory PA are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.

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



**5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)**

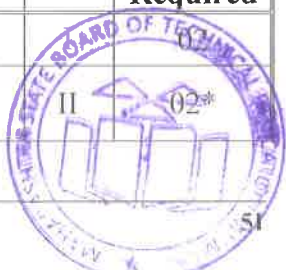
This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.



**Figure 1 - Course Map**

**6. SUGGESTED PRACTICALS/ EXERCISES**

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1.	Identify the road traffic characteristics for any existing road.		02
2.	Measure the traffic volume in morning peak hours to analyze traffic composition on road way.		02

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
3.	Measure the traffic volume in evening peak hours to analyze traffic composition on road way.	II	02
4.	Measure the traffic volume in non peak hours to analyze traffic composition on road way.	II	02
5.	Measure the traffic volume in morning peak hours to analyze traffic composition at Intersection.	II	02*
6.	Measure the traffic volume in evening peak hours to analyze traffic composition at Intersection.	II	02
7.	Measure the traffic volume in non peak hours to analyze traffic composition at Intersection.	II	02*
8.	Prepare a report of trip generation and trip attraction between two zones on the basis of origin-destination study within area of your town/city.	II	02*
9.	Measure the spot speed on corridor of road way to analyze the percentile speed graphically.	II	02*
10.	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*
11.	Prepare a report of a field visit to any minor road intersection in your locality to identify the type, working of traffic signals along with your recommendations if any.	III	02
12.	Suggest the relevant vehicle parking system for your campus along with your recommendations if any in the form of a report.	III	02*
13.	Prepare a report of a field visit to any urban road way to identify the road signs and corresponding markings on road.	III	02
14.	Prepare a report of a field visit to any urban road to identify the traffic island along with its sketch.	III	02
15.	Prepare a report of a field visit to any road intersection in your locality to identify its type along with its sketch.	IV	02*
16.	Identify the existing street lighting system of any two types of roads.	IV	02
17.	Locate the points of conflicts in the diagram of a busy intersection on a major urban road in your locality.	IV	02
18.	Identify the existing type of trees to suggest any relevant maintenance required.	V	02
19.	Draw the collision diagram for any case study of road accident.	VI	02*
20.	Prepare the report on the causes of accidents and preventive measures suggested by you for the situation in practical no 18.	VI	02*
	<b>Total</b>		<b>32</b>

**Note**

- i. A suggestive list of **PrOs** is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '\*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- ii. The 'Process' and 'Product' related skills associated with each PrO are to be assessed according to a suggested sample given below:



S. No.	Performance Indicators	Weightage in %
a.	Observation	40
b.	Following safety measures during work	10
c.	Active participation in team work	10
d.	Interpretation of observations and suggestions given	30
e.	Report submission in time	10
<b>Total</b>		<b>100</b>

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- a. Follow safety practices on road.
- b. Developing skill of helping the needy.
- c. Develop the leadership quality.
- d. Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1<sup>st</sup> year
- 'Organising Level' in 2<sup>nd</sup> year and
- 'Characterising Level' in 3<sup>rd</sup> year.

## 7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO. S. No.
1.1	Computer system (Any computer system with basic configuration)	All
1.2	Drawing board with accessories	All
1.3	LCD Projector with accessories	All
1.4	Measuring tape.	13,14, 15
1.5	Line dori, white wash, brush	13,14, 15

## 8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop UOs in cognitive domain for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
<b>Unit – I Fundamentals of Traffic Engineering.</b>	1a. Describe the characteristics of road users in the given situation.. 1b. Describe the vehicular characteristics for the given situation. 1c. Calculate reaction time of	1.1 Traffic engineering- Definition, objects, scope 1.2 Road user's characteristics-physical, mental, emotional factors. 1.3 Vehicular characteristics-width, length, height, weight, speed, efficiency of brakes.



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	driver in the given situation. 1d. Explain the factors affecting the reaction time for the given situation.	1.4 Road characteristics-gradient, curve of a road, design speed, friction between road and tyre surface. 1.5 Reaction time-factors affecting reaction time. PIEV Theory.
<b>Unit- II Traffic Studies</b>	2a Measure the traffic volume for the given section of road. 2b Analyze origin-destination studies data collected for the given road. 2c Analyze spot speed study data collected for the given road. 2d Design and develop the parking system for the given situation. 2e Suggest the improvement in road geometrics for the given road based on traffic volume count with justification.	2.1 Traffic Studies –types, purpose, Information required for traffic studies. 2.2 Traffic volume study-definition, purpose. 2.3 Methods of collection of traffic volume count data-manual, automatic recorders, moving car method 2.4 Traffic volume count data-representation and analysis of data. 2.5 Necessity of Origin and Destination study and its methods. 2.6 Speed studies-spot speed studies, and its presentation 2.7 Need and method of parking study.
<b>Unit III- Road Signs and Traffic Markings</b>	3a. Interpret the traffic signs at the given road intersection or road. 3b. Suggest the road signs for given traffic situation with justification. 3c. Explain the necessity of pavement markings for given road and road intersection. 3d. Draw the relevant markings on the given pavement.	3.1 Traffic control devices –definition, necessity, types. 3.2 Road signs-definition, objects of road signs. 3.3 Classification as per IRC: 67-1977- Mandatory or Regulatory, Cautionary or warning, informatory signs, Location of cautionary or warning sign in urban and non-urban areas, Points to be considered while designing the road signs. Points to be considered while erecting the road signs. 3.4 Traffic markings- definition 3.5 Classification of traffic markings- carriage way, kerb, object marking and reflector markers
<b>Unit-IV Traffic Signals and Traffic Islands.</b>	4a Justify the necessity of given traffic signal at the inter section of a road. 4b Explain the principle of coordinated signals on the given road section. 4c Categorize the existing traffic island at the given road intersection. 4d Suggest the relevant measures to guide the traffic	4.1 Traffic signals- Definition, 4.2 Types of signals-Traffic control signals, pedestrian signals, special type of traffic signals, 4.3 Types of traffic control signals.-Fixed time, manually operated, traffic actuated signals 4.4 Location of signals 4.5 Compute signal time by fix time cycle, trail cycle, approximate, Webster's and IRC method and sketch timing



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	in the given situation with justification..	<p>diagram for each face.</p> <p>4.6 Traffic islands –Definition, advantages and disadvantages of providing islands.</p> <p>4.7 Types of traffic islands-rotary or central, channelizing or Refuge Island.</p> <p>4.8 Road intersections or junctions- Definition, Types of road intersection.</p> <p>4.9 Intersection at grade- Types, basic requirements of good intersection at grade.</p> <p>4.10 Grade separated intersection- advantages and disadvantages, types- over pass or flyovers-Cloverleaf pattern, Trumpet type, underpass</p> <p>4.11 Segregation of traffic-Definition, purpose, types.</p>
<b>Unit –V Road Environment and Arboriculture</b>	<p>5a. Suggest the street lighting system for the given road section.</p> <p>5b. Recommend the relevant type of trees for road side plantation.</p> <p>5c. Justify the need of protecting the road side plantation.</p> <p>5d. Describe the methods of protecting the road side plantation.</p>	<p>5.1 Street lighting –definition, sources necessity, types-luminaire, foot candle, lumen, factors affecting their utilization and maintenance.</p> <p>5.2 Factors affecting visibility at night.</p> <p>5.3 Arboriculture- definition, objectives, factors affecting selection of type of trees.</p> <p>5.4 Maintenance of trees-protection and care of road side trees</p>
<b>Unit –VI Road Accident Studies</b>	<p>6a. Analyze the causes of accident occurred on the given road section.</p> <p>6b. Suggest preventive measures to avoid the accidents on the given road section.</p> <p>6c. Create awareness about the traffic rules and laws at selected location.</p>	<p>6.1 Road accidents-Definition, types- Collision and non-collision accidents</p> <p>6.2 Causes of accidents</p> <p>6.3 Measures to prevent road accidents</p> <p>6.4 Reporting and recording of an accident</p> <p>6.5 Collision and condition diagram</p> <p>6.6 Considerations regarding road safety</p> <p>6.7 Legislation and law enforcement, education and propaganda</p>

*Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.*

### 9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Fundamentals of Traffic Engineering	02	04	--	--	04
II	Traffic Studies	08	02	04	06	12
III	Road Signs and Traffic Markings	12	02	04	06	16

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
IV	Road Signals and Traffic Islands.	12	02	08	06	16
V	Road Environment and Arboriculture	06	--	08	--	08
VI	Road Accident Studies	08	--	08	06	14
<b>Total</b>		<b>48</b>	<b>10</b>	<b>36</b>	<b>24</b>	<b>70</b>

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

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

### 10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related *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:

- Prepare journals based on practical performed in laboratory.
- Group discussion on traffic jams and related probable solutions in the city.
- 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 learning outcomes in this course:

- Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics.
- 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
- Guide student(s) in undertaking micro-projects.
- Demonstrate the particular situation before undertaking the task in practice.
- Train the students to help competent authority for guiding the traffic movements at an intersection.
- Show video clips of nearby road with traffic movements and discuss the shortcomings in the road design
- Show picture clips/photographs of Road accidents and discuss the features of road system design which could have prevented such accidents.
- Arrange expert lectures by traffic system designers.
- Arrange the brain storming sessions for suggesting the viable solution for a specific traffic problem.

### 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-project 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, workshop-based, 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 are given here. Similar micro-projects could be added by the concerned faculty:

- a. Prepare a model of traffic controlling devices.
- b. Make posters showing traffic safety and awareness.
- c. Perform traffic survey of busy road junction of city in groups and to suggest measures for improvement.
- d. Prepare a report on advanced road marking machinery and materials.
- e. Undertake the process of planting, protecting and maintaining the trees along the road.
- f. Prepare the charts showing different types of road signs.

### 13. SUGGESTED LEARNING RESOURCES :

S. No.	Title of Book	Author	Publication
1	Transportation Engineering	Arora, N. L.	Khanna Publishers, Delhi, 1996, ISBN: 81-7319-0933.
2	Traffic Engineering and Transport Planning	Kadiyali, L.R.	Khanna Publishers, Delhi, 2001, ISBN:10: 8185240779;
3	Transportation Engineering Vol. I & II	Vazirani, V N Chaondola, S P	Khanna Publishers. Delhi, 2016 ISBN: 9780128038185; 9780128038895
4	Traffic planning and design	Saxsena, S C	Dhanpat Rai & Sons Delhi, 2016 ISBN-10: 8123915500
5	Indian Highways- IRC Journal	Journal-monthly issue	IRC (Indian Road Congress), India, 1973, ISSN: 0376-7256

### 14. SOFTWARE/LEARNING WEBSITES

- a. <http://www.sanfoundry.com/highway-engineering-questions-answers-traffic-engineering/>
- b. <https://www.youtube.com/watch?v=G7qU7H0w9QA>
- c. <http://freevideolectures.com/Course/91/Introduction-to-Transportation-Engineering/4>
- d. <https://www.slideshare.net/AtifKhan178/road-arboriculture>
- e. <https://www.youtube.com/playlist?list=PLCC59953860B62145>
- f. <http://nptel.ac.in/downloads/105101008/>
- g. [http://nptel.ac.in/courses/105101008/downloads/cete\\_29.pdf](http://nptel.ac.in/courses/105101008/downloads/cete_29.pdf)
- h. [http://nptel.ac.in/courses/105101008/downloads/cete\\_38.pdf](http://nptel.ac.in/courses/105101008/downloads/cete_38.pdf)

