Govt. of Bihar
MUZAFFARPUR INSTITUTE OF TECHNOLOGY, MUZAFFARPUR, BIHAR – 842003

(Under the department of Science &Technology, Bihar, Patna)

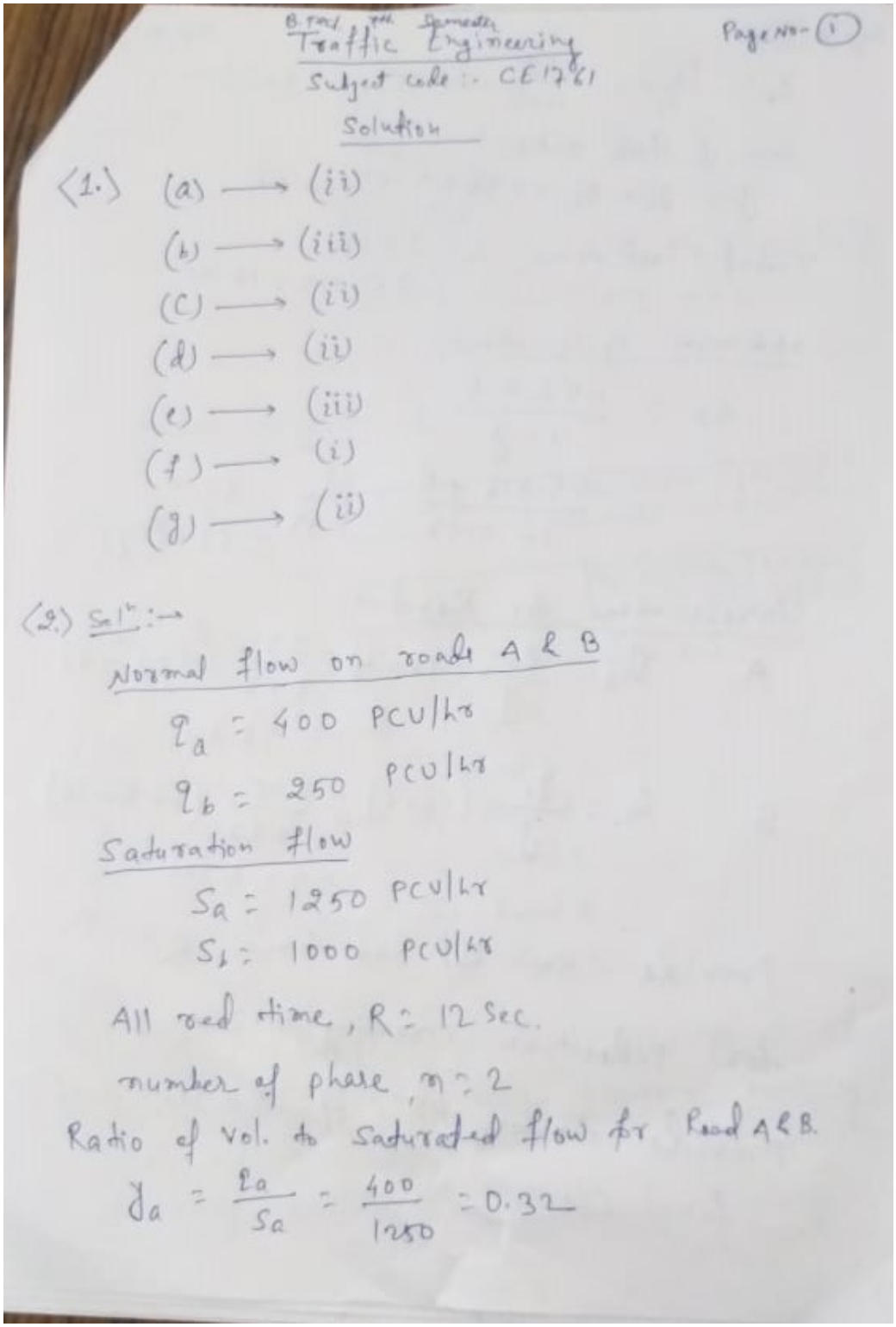
B. Tech. 7th Semester Mid-Term Examination Answers, 2018

Traffic Engineering

Time: 2 hours **Full Marks: 20**

Subject Code: CE1761

Answers for the questions



B.Tech 7th Semester
Traffic Engineering
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Solution

(1.) (a) ⟶ (ii)
(b) ⟶ (iii)
(c) ⟶ (ii)
(d) ⟶ (ii)
(e) ⟶ (iii)
(f) ⟶ (i)
(g) ⟶ (ii)

(2.) Sol^{n} :⟶

Normal flow on roads A & B

q_a = 400 PCU/hr

q_b = 250 PCU/hr

Saturation flow

S_a = 1250 PCU/hr

S_b = 1000 PCU/hr

All red time, R = 12 Sec.

number of phase, n = 2

Ratio of vol. to saturated flow for Road A & B.

$$y_a = \frac{q_a}{S_a} = \frac{400}{1250} = 0.32$$

$$y_b = \frac{q_1}{s_1} = \frac{250}{1000} = 0.25$$

Sum of these ratio

$$y = y_a + y_1 = 0.32 + 0.25 = 0.57$$

Total lost time, $L = 2n + R$
$= 2 \times 2 + 12 = 16$ sec

optimum cycle time,

$$C_0 = \frac{1.5L + 5}{1 - y}$$

$$= \frac{1.5 \times 16 + 5}{1 - 0.57} = \frac{29}{0.43} = 67.4$$
$\simeq 67.5$ (say)

Green time for Road

A, $G_a = \frac{y_a}{y}(C_0 - L) = \frac{0.32}{0.57}(67.5 - 16)$

$= 29$ sec.

B, $G_1 = \frac{y_1}{y}(C_0 - L) = \frac{0.25}{0.57}(67.5 - 16)$

$= 22.5$ sec.

Provide an all Red time, R

for Pedestrian crossing = 12 sec.

provide Amber time of 2.0 sec each for clearance.

Total cycle time.

$= G_A + A_A + R_A + R$

$= G_A + A_A + G_B + A_B + R$

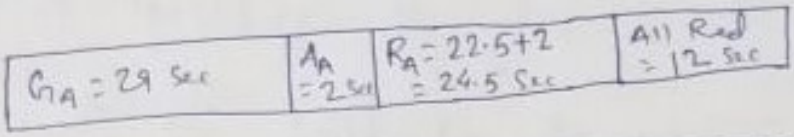
$[\because R_A = G_B + A_B]$

$= 29 + 2 + 22.5 + 2 + 12$

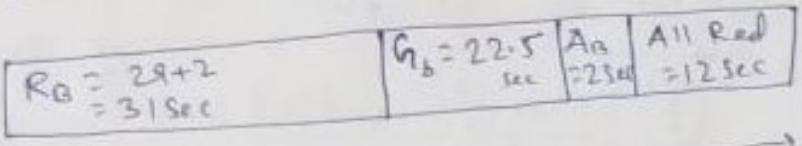
$= 67.5$ sec.

phase diagram for

Road A;



Road B;



← Total cycle time →

G_A = Green time for Road A.

G_B = " " " Road B

A_A = Amber time for Road A

A_B = " " Road B

R_A = Red time for Road A

R_B = " " Road B

Sol^n :→ A conflict point is the point at which a highway user crossing, merging with, or diverging from a road or driveway conflicts with another highway

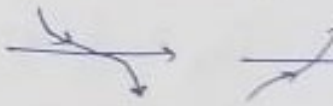
wer using the same road or driveway.
It is any point where the paths of two through or turning vehicles ~~drive~~ diverge, merge, or cross.

→ Conflicts points are commonly used to explain the accident potential of a roadw Access management strategies are typically designed to reduce the number and density of conflicts points.

Types of Conflict :→ There are four basic type of conflict discuss below.

(1) Major Conflict

(a) crossing Conflict 

(b) Weaving Conflict 

(2) Minor Conflict

(c) Merging Conflict 

(d) Diverging Conflict 

* Crossing conflict :→ Crossing conflicts occ when vehicles from different directions attempt to head-on cross paths at a single location. Crossing conflicts are considered to be the most dangerous ty of conflict and a major concern during traffi intersection design.

* Weaving conflict :→ It is also a type of crossing conflict in which both merging & diverging take place simultaneously. It is also considered to be the dangerous type of conflict and are a major concern during traffic intersection design.

* Merging conflicts :→ Merging conflicts occur when vehicles from different lanes or directions merge into a single lane moving in a single direction. This situation creates a bottleneck and forces the traffic to move from a larger space and less congested state into a narrower space and a more congested state.

* Diverging Conflicts :→ Diverging conflicts are created when the flow of traffic travelling in a single direction separated into different directions. These are generally considered to be the least problematic of the four conflict types. Diverging roadways create a reverse bottleneck, with traffic moving from a more congested and constrained space to a more open space. This, in itself, is not a problem. However, vehicles tend to slow when changing directions or making navigation decisions.

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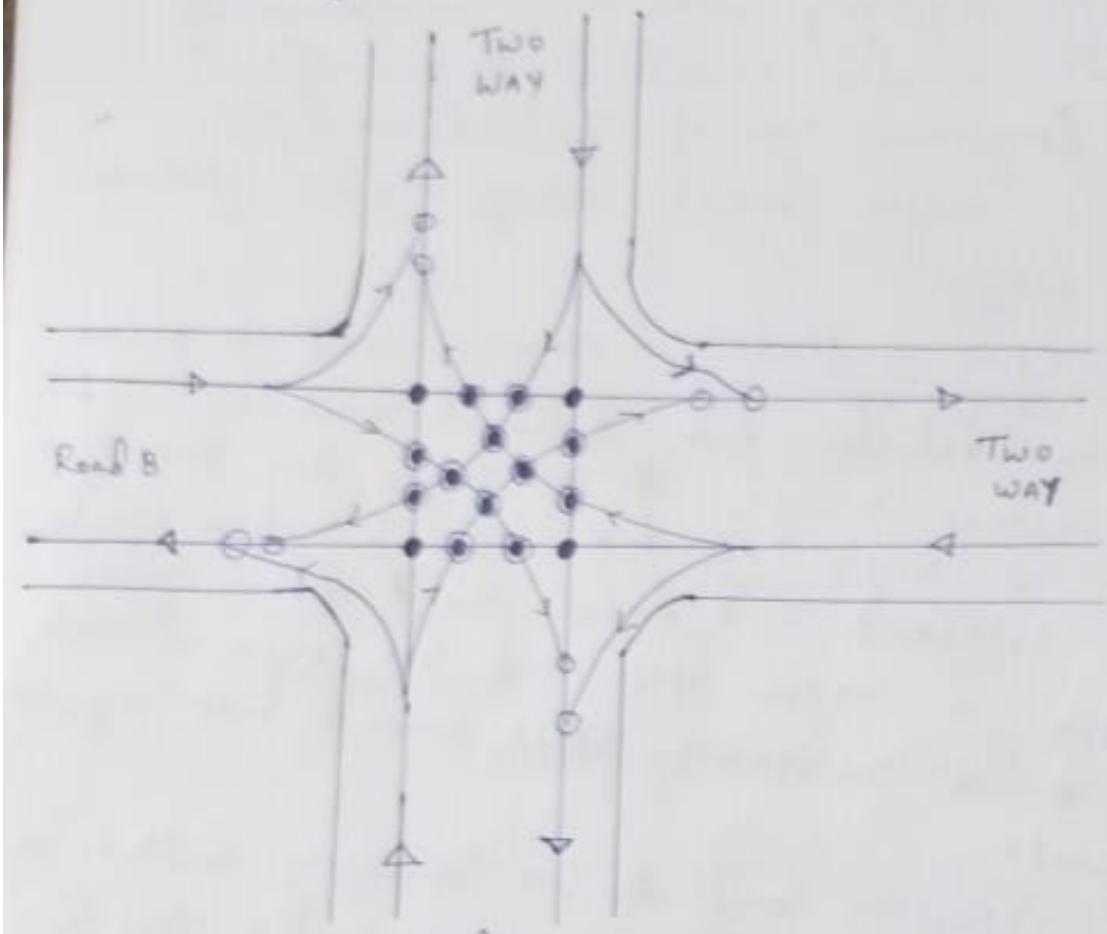
Number of conflict points in 2-way - 2 lane Road



Number of Conflicts

Crossing conflicts ● = 04

Weaving conflicts ◉ = 12

Merging conflicts ○ = 08

Total Conflicts = 24 without Pedestrian conflicts.

Pedestrian crosswalk: 08

Total conflicts 32 with pedestrian crosswalk

Answer for Question number 5

Spot speed is the instantaneous speed of a vehicle at a specified location. Spot speed can be used to design the geometry of road like horizontal and vertical curves, super elevation etc.

Running speed is the average speed maintained over a particular course while the vehicle is moving and is found by dividing the length of the course by the time duration the vehicle was in motion.

Journey speed is the effective speed of the vehicle on a journey between two points and is the distance between the two points divided by the total time taken for the vehicle to complete the journey including any stopped time.

Time mean speed is defined as the average speed of all the vehicles passing a point on a highway over some specified time period.

$$v_t = \frac{1}{n}\sum_{i=1}^{n} v_i,$$

where vi is the spot speed of ith vehicle, and n is the number of observations.

Space mean speed is defined as the average speed of all the vehicles occupying a given section of a highway over some specified time period.

$$v_s = \frac{n}{\sum_{i=1}^{n} \frac{1}{v_i}}.$$

Both mean speeds will always be different from each other except in the unlikely event that all vehicles are traveling at the same speed. Time mean speed is a point measurement while space mean speed is a measure relating to length of highway or lane, i.e. the mean speed of vehicles over a period of time at a point in space is time mean speed and the mean speed over a space at a given instant is the space mean speed.

Answer for question no:6

Flow-density curve

The flow and density varies with time and location. The relation between the density and the corresponding flow on a given stretch of road is referred to as one of the fundamental diagram of traffic flow. Some characteristics of an ideal flow-density relationship is listed below:

1. When the density is zero, flow will also be zero, since there is no vehicles on the road.

2. When the number of vehicles gradually increases the density as well as flow increases.

3. When more and more vehicles are added, it reaches a situation where vehicles can't move. This is referred to as the jam density or the maximum density. At jam density, flow will be zero because the vehicles are not moving.

4. There will be some density between zero density and jam density, when the flow is maximum. The relationship is normally represented by a parabolic curve as shown in figure 1.

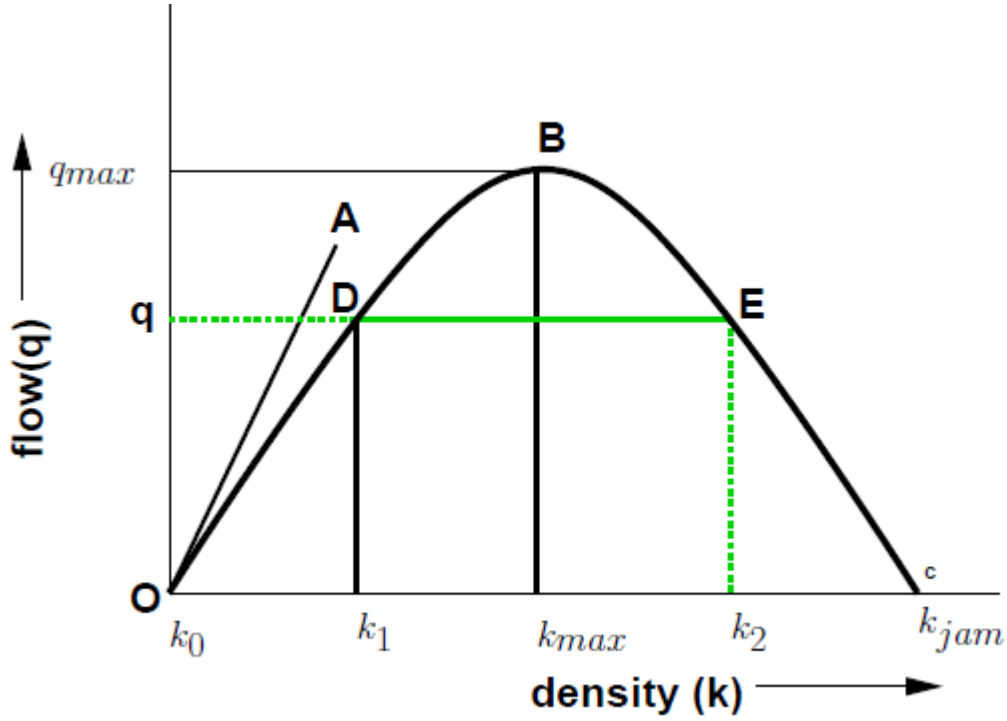


Figure-1

Speed-density diagram

Similar to the flow-density relationship, speed will be maximum, referred to as the free flow speed, and when the density is maximum, the speed will be zero. The most simple assumption is that this variation of speed with density is linear as shown by the solid line in figure 2. Corresponding to the zero density, vehicles will be flowing with their desire speed, or free flow speed. When the density is jam density, the speed of the vehicles becomes zero. It is also possible to have non-linear relationships as shown by the dotted lines. These will be discussed later.

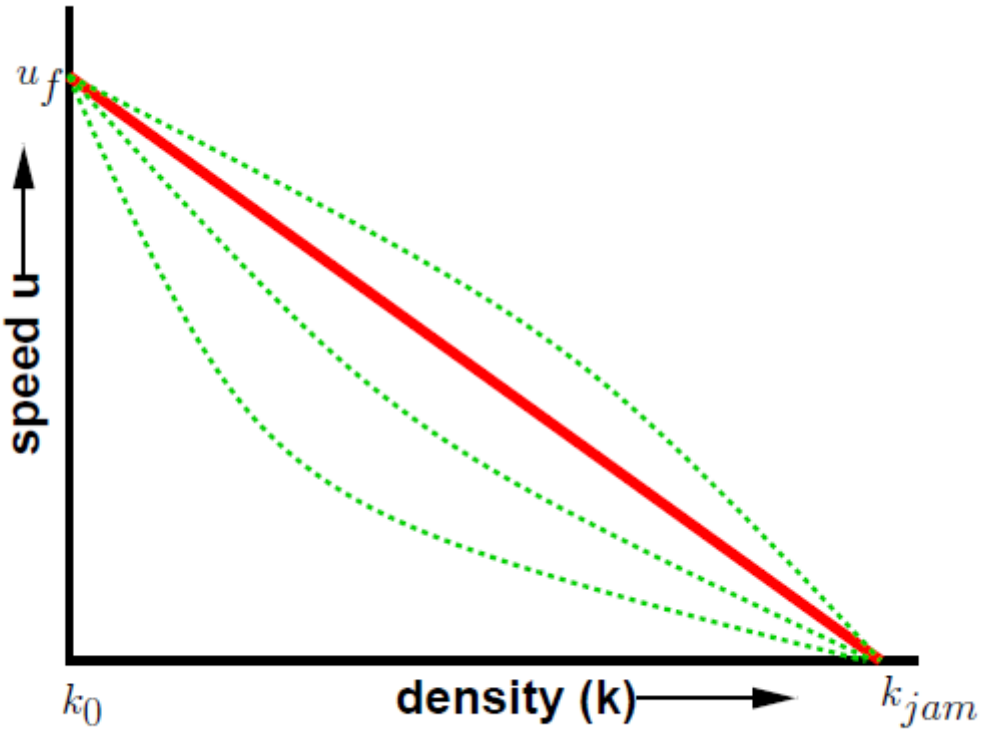


Figure-2

Speed flow relation

The relationship between the speed and flow can be postulated as follows. The flow is zero either because there is no vehicles or there are too many vehicles so that they cannot move. At maximum flow, the speed will be in between zero and free flow speed. This relationship is shown in figure 3. The maximum flow qmax occurs at speed u. It is possible to have two different speeds for a given flow.

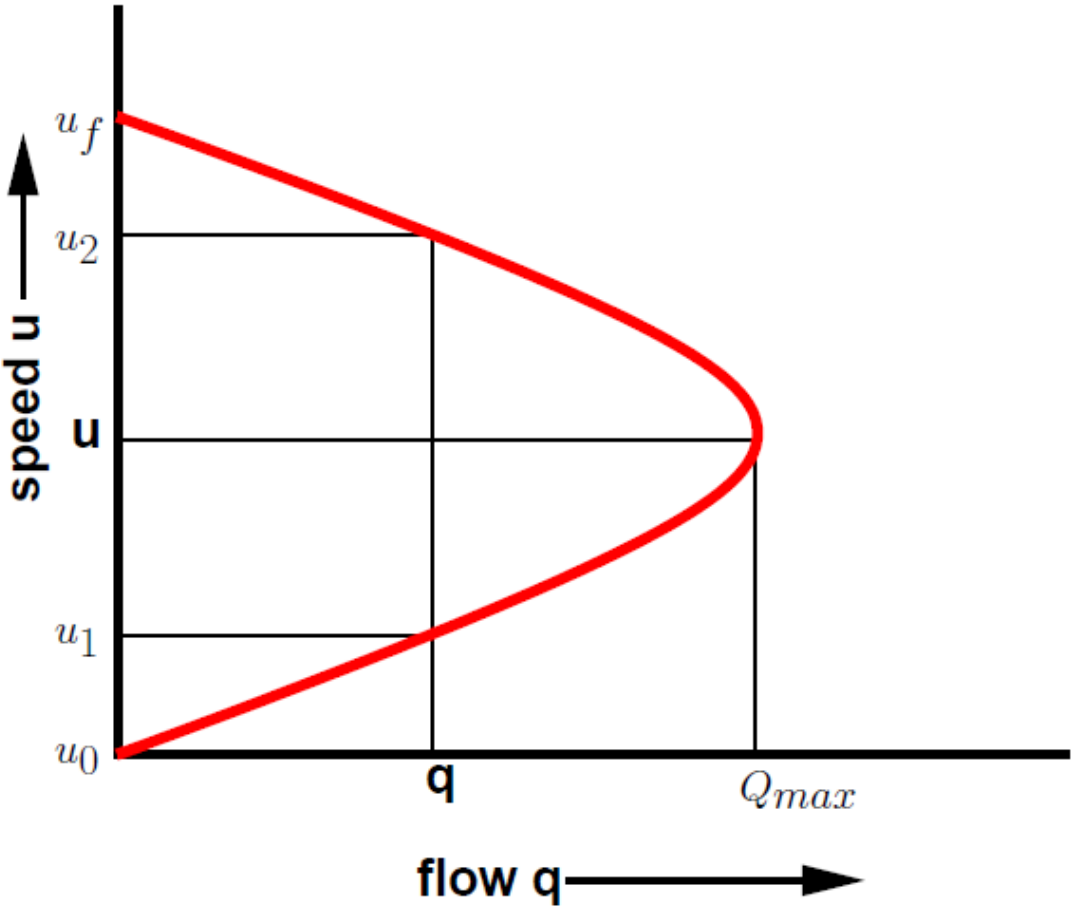


Figure-3