



## FINAL EXAM

### Question 1:

(12 points)

Choose the correct answer:

1. If the lane width of a 4-lane freeway is 3.5m, the median width is 4m, the shoulder width is 2.0m and width of side slope is 5m, then, the width of right of way will be:  
 a. 14m  
 b. 18m  
 c. 32m  
 d. 64m
2. The shoulder is a basic element of the cross-section of:  
 a. urban freeway  
 b. rural freeway  
 c. both urban and rural freeways  
 d. local street
3. The usual sequence of signal aspects or indications in the UK is:  
 a. Amber  $\Rightarrow$  Red  $\Rightarrow$  Green  $\Rightarrow$  Red/Amber  
 b. Red  $\Rightarrow$  Amber  $\Rightarrow$  Red/Amber  $\Rightarrow$  Green  
 c. Red  $\Rightarrow$  Green  $\Rightarrow$  Red/Amber  $\Rightarrow$  Amber  
 d. Red  $\Rightarrow$  Red/Amber  $\Rightarrow$  Green  $\Rightarrow$  Amber
4. A signalized intersection is operated with three-phase system; each phase has an actual green time equal to 20 sec. If the inter-green period is 8sec, the cycle time will be:  
 a. 84 sec  
 b. 28 sec  
 c. 68 sec  
 d. 44 sec
5. Assuming the inter-green time is 12 sec, the red/amber is 2sec and the yellow time is 4 sec, the all-red time will be:  
 a. 16 sec  
 b. 8 sec  
 c. 3 sec  
 d. 6 sec
6. An airport has 15 gates and a mean time for stand occupancy and a utilization factor of 45 minutes and 0.85 respectively. The maximum number of aircrafts that can be serviced at this airport per hour is.  
 a. 17  
 b. 13  
 c. 15  
 d. 11

**Question 2:**

**(10 points)**

**Study the following statements & indicate if they are (True or False)**

- 1- As cycle length increases delay increases.
- 2- As proportion of turning vehicles in a lane increases saturation flow rate decreases.
- 3- As circulating flow increases the entry capacity of a roundabout increases.
- 4- Pavement markings always replaces traffic signs.
- 5- The controller is an electrical device located in a cabinet for controlling the operation of a traffic control signal.
- 6- The 1st traffic signal was erected in London in 1768
- 7- When the width of intersection increases, the all-red time increases.
- 8- When the flow of crossing pedestrians increases the inter-green period decreases.
- 9- Vehicle actuation is a type of traffic control strategies, which doesn't require vehicle detection.
- 10- The lost time increases as the inter-green period decreases.

**Question 3:**

**(5 points)**

**For each of the following signs, the used shape is:**

	<b>The sign</b>	<b>The shape</b>	<b>Or (Sketch)</b>
1.	Stop Sign	.....	
2.	Yield Sign	.....	
3.	No Passing Zone	.....	
4.	Railway Crossing	.....	
5.	Recreational Guide	.....	



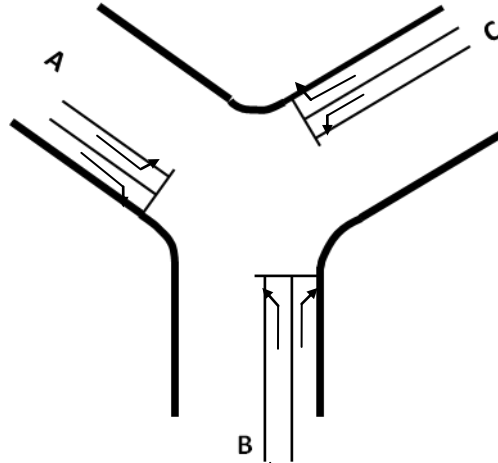
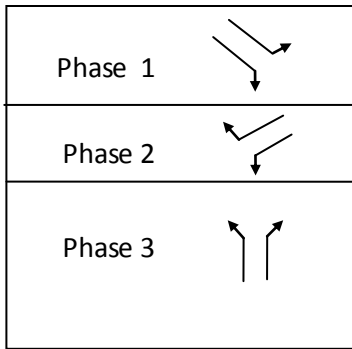
**Question 5:**

**(10 points)**

The Figure below shows a sketch of the layout and a proposed 3-phase system at a signalized intersection. The approaching flow and the calculated saturated flow for each lane are as follows:

Lane (From- To)	A-B	A-C	B-A	B-C	C-A	C-B
Flow (PCU/hr)	250	400	400	380	150	200
Saturation flow (PCU/hr)	1200	1600	1300	1700	800	1500

**3-phase system**



- a) The actual periods of green time for phases 1, 2, and 3 were calculated to be 26, 33, 21 seconds respectively assuming the inter-green period to be 5 seconds. **Based on the previous data, Calculate the capacity for each lane, then, calculate the total intersection capacity.**

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- b) It is required to redesign this intersection as a roundabout with no flare. Assume that for all approaches, inscribed circle diameter is 25m, approach half width is 6m, entry radius is 8m and the entry angle is 15 degrees. **Calculate the capacity for each approach, then the total intersection capacity.** Make any necessary reasonable assumptions.

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c) *Decide which design, signal or roundabout, is better based on the total intersection capacity.*





## Useful Formula

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

$$f_{HV} = 1 / [1 + P_i (E_i - 1)]$$

$$Q_e = K(F - f_c * Q_c) \quad \dots \text{when } f_c Q_c \leq F$$

$$Q_e = 0 \quad \dots \text{when } f_c Q_c > F$$

$$K = 1 - 0.00347(\phi - 30) - 0.978[(1/r) - 0.05]$$

$$F = 303 X_2,$$

$$f_c = 0.210 t_D (1 + 0.2 X_2)$$

where:

$$X_2 = v + (e - v) / (1 + 2S)$$

$$S = 1.60 (e - v) / l'$$

$$t_D = 1 + 0.5 / (1 + M)$$

$$M = \exp[(D - 60) / 10]$$

$$n = \frac{vt}{u}$$