BENGAL ENGINEERING AND SCIENCE UNIVERSITY, SHIBPUR

M.E.(Civil Engineering) 2nd Semester Final Examination, 2013

Traffic Flow Theory and Control

(CE- 1023)

Time: 3 Hours | Full Marks: 70

*Answer any **Five** questions*
Assume data suitably reasonably, if required

1. a) What is control delay for a signalized intersection? State the parameters on which control delay depends. Draw the flow diagram showing signalized intersection methodology-HCM 2000 for determining LOS.

   b) An intersection approach at an isolated pre-timed signal with a cycle length 75 seconds has a saturation flow rate of 2800 veh/h. The length of green time is 25 second. The v/c ratio is 0.85. What is the control delay per vehicle if control delay is measured over 15 min. interval?

   [2+2+4+6=14]

2. a) Derive the generalized fifth and final General Motor's Car following model with usual notation representing the total m, l, matrix

   [14]

3. a) A queuing system has single channel, poisson distributed arrivals, exponentially distributed service rate, channels are in parallel, and in steady state condition. Derive the equation for expected number of vehicles in the queuing system.

   b) Vehicles arrive at a stop sign at an average rate of 310 per hour. Average waiting time at the stop sign is 10 second per vehicle. If both arrivals and departures are exponentially distributed, what are the average queue length and the average waiting time per vehicle?

   [9+5 = 14]

4. a) Define capacity of an interrupted flow facility. Discuss the method of estimation of saturation flow rate of an interrupted flow facility.

   b) What is uniform delay progression adjustment factor? State the components on which the progression adjustment factor depends.

   [2+6+3+3 = 14]

5. a) a) State the Webster's delay model for estimating the average delay per vehicle at signalized intersection

b) An approach has an effective green time of 70 second and an optimum cycle time 110 second. The actual flow on the approach is 900 vehicles per hour, with its saturation flow estimated at 1650 vehicles per hour. Calculate the average delay per vehicle using both the precise and approximate formula

[8+6=14]

6. a) What is inter-green period? State the advantages of traffic signal control.

b) The following hourly flow and saturation flows related to an intersection to be controlled by two phase signal system incorporating a late start facility to any one phase is given below. The amber duration is 3 second. Minimum inter-green period is employed and starting delay is 2 second. Design the traffic signal.

Approach	Movement	Flow (PCU/hr)	Saturation flow (PCU/hr)
North	Left turn	220	1800
	Straight ahead	500	2800
	Right turn	190	1400
South	Left turn	290	1800
	Straight ahead	490	2800
	Right turn	160	1400
East	Left turn	190	1800
	Straight ahead	510	2800
	Right turn	190	1400
West	Left turn	180	1800
	Straight ahead	530	2800
	Right turn	170	1400

[2+3+9 = 14]