MACHAKOS UNIVERSITY

University Examination 2018/2019

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

FOURTH YEAR SECOND SEMESTER EXAMINATION

BACHELOR OF SCIENCE (CIVIL ENGINEERING)

ECV 408: TRAFFIC ENGINEERING II

DATE: 22/5/2019 **TIME: 8.30-10.30 AM**

INSTRUCTIONS

a) This paper contains FIVE (5) questions.
b) You are required to answer THREE (3) questions only.
c) Question ONE is compulsory.
d) Attempt any other TWO questions.
e) Question ONE carries 30 marks and the others carry 20 marks each.

QUESTION ONE (COMPULSORY))(30 MARKS)

a) Using speed Vs flow of vehicles relationship given in fig 1 below, describe the flow conditions in zone SP, PBC and OC. (6 marks)

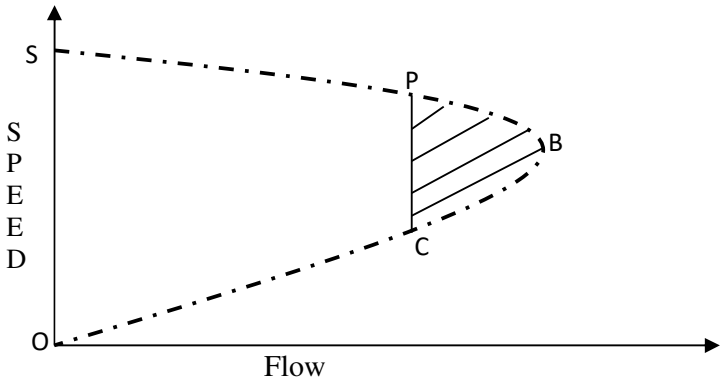

Fig 1

b) Discuss **four** common forms of vehicle movement control traffic management (8 marks)

c) One lane of a 2-lane one-way carriageway is closed for repairs. The maximum mean free speed under conditions of low flow in the 2-lane portion is 65km/hr. under condition of low flow, observations show that the maximum mean free speed in the bottleneck is also

65km/hr. the average space headway when vehicles are stationary is 12.5m. the volume of traffic on the 2-lane road is 1800 veh/hour.

Assuming that the speed-concentration relation is linear, find

i) The mean speed of traffic through the bottleneck caused by the closure of one lane

ii) The mean speed of traffic in the congested conditions immediately on the approach to the bottleneck

iii) The mean speed of traffic on the carriageway clear of the influence of the bottleneck

iv) The rate at which the queue of the congested traffic entering the bottleneck grows

(8 marks)

d) Figure 1 below shows the minimum paths tree connecting zone centroid 1 with zone centroids 2, 3, 4, 5 and 6. Using traffic volumes in table1, determine traffic volumes assigned to links 1-11, 11-12, 12-2, 11-15, 15-18, 18-3 and 18-4.

Table 1: traffic volume from zone centroid 1 with zone centroids 2, 3, 4, 5 and 6.

From zone centroid	To zone centroid	Traffic Volume(Vehicles/hour)
1	2	2500
1	3	3400
1	4	4500
1	5	5200
1	6	6500

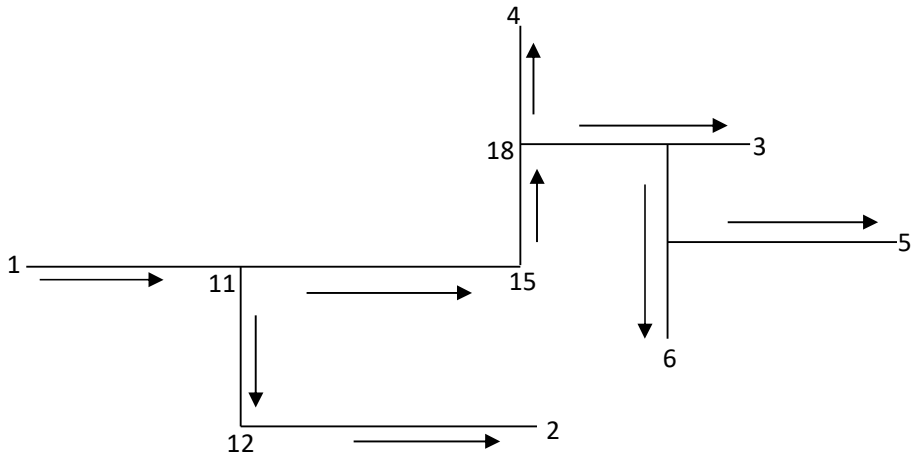

Figure 1: minimum paths tree connecting zone centroid 1 with zone centroids 2, 3, 4, 5 and 6.

(8 marks)

QUESTION TWO (20 MARKS)

a) What is traffic assignment? (2 marks)

b) Give **three** applications of traffic assignment (3 marks)

c) Describe the multi-route method of traffic assignment and state the three assumptions on which this method is based. (5 marks)

d) The total trip volumes from zone 1 to 2 are 2000. By use of TRC trip assignment model, find the volumes on each route connecting the two zones using the particulars given in the table 2 below (10 marks)

Table 2: traffic flow route data

Route No.	Length (km)	Speed (km/hr)
1	2	30
2	1.7	20
3	1	5
4	2.5	15

QUESTION THREE (20 MARKS)

a) Define the following terms

i. Uninterrupted flow

ii. Interrupted flow

iii. Bottle neck

iv. Nodes

v. Links (5 marks)

b) Between two zones 1 and 2, there are two routes whose characteristics are given in table 1. The total number of trips between the two zones is 1200 trips per hour. Find the volumes on each route connecting the two zones.

Hint: use the TRC trip assignment model and follow the iteration method to the second iteration

Table 1

Route Number	Number of lanes	Speed Limits (km/h)	Length (km)	Critical Volume (Vph/lane)	Critical travel time (min/km)	Ideal travel time with no veh (min/km)
1	one	30	3	600	3	2.5
2	one	50	4	1100	2	1.5

Take d = 0.5 for $V_r<V_{rc}$ and d = 10.0 for $V_r>V_{rc}$

(15 marks)

QUESTION FOUR (20 MARKS)

a) State four components of congestion costs in traffic management (2 marks)

b) The national park service plans to develop a wide area for tourism. Six locations in the area are very important. The distances between them (in KM) are given in table 3 below. The park management want to minimise the KM of the total distance to see all the six spaces. Determine how the road should be constructed to achieve this objective. A is the entrance to the park (18 marks)

Table 3: The Park routes

From	To	Distance
A	B	20
A	E	100
A	D	20
A	C	40
B	D	10
C	D	40
C	G	30
D	G	70
D	F	100
D	E	70
E	F	80
E	G	50
F	G	30

QUESTION FIVE (20 MARKS)

a) State **four** benefits of parking control and restraints in traffic management (2 marks)

b) State the **four** primary variables used to describe the flow of vehicles on a path. (2 marks)

c) An Engineer who lives in R and works in W seeks a route that will minimise the morning driving time. He has recorded the driving time in minutes between the intermediate nodes. There are no major roads directly linking some of the nodes as shown in table 5. Determine the best commuting route for this engineer. (16 marks)

Table 5: route details

	R	C	O	T	P	W
R	-	18	-	32	-	-
C	18	-	12	28	-	-
O	-	12	-	17	-	32
T	32	28	17	-	4	17
P	-	-	-	4	-	11
W	-	-	32	17	11	-