UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2012/2013

COURSE NAME	:	ADVANCED TRAFFIC ENGINEERING
COURSE CODE	:	BFT 40503 / BFT 4053
PROGRAMME	:	4 BFF
EXAMINATION DATE	:	JUNE 2013
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **EIGHT (8)** PAGES

Q1 (a) With the help of graphs and equations, compare the speed-density relationships as proposed by Greenshields (1934) and Greenberg (1959).

(10 marks)

(b) Figure **Q1** shows a time-space diagram produced from a traffic flow study of 6 vehicles traversing an uninterrupted 1 km section of a major arterial road in a period of 1 minute. Based on the time-space diagram,

(i) Determine the time mean speed and space mean speed.
(ii) Estimate the flow, density and mean speed of the traffic stream.

(15 marks)

Q2 (a) (i) Describe how shockwaves are formed in traffic.
(ii) Mention **TWO (2)** characteristics of a shockwave.
(iii) State **FOUR (4)** common causes of shockwaves.

(10 marks)

(b) A traffic stream, having a flow rate of 1,250 veh/h, is travelling at a mean speed of 54.3 km/h on a section of a two-lane rural trunk road in the westbound direction. A freight truck joins the traffic stream at a speed of 25 km/h. The truck travels for a length of 2 km before exiting the road. Due to high flow of traffic in the opposite direction, it is impossible for any vehicle to overtake the truck. As a result, the vehicles behind the truck form a platoon having a density of 60 veh/km and a flow rate of 940 veh/h. Determine,

(i) The magnitude of the shockwave speed and direction of the shockwave.
(ii) The length of the platoon and the number of vehicles in the platoon before the truck exits the road.

(15 marks)

Q3 (a) Define "road pricing". Mention the **TWO (2)** main objectives of road pricing.

(3 marks)

(b) In your opinion, should road pricing be implemented in Malaysia? Justify your answer.

(4 marks)

(c) The strategies for congestion management of a transport facility can be grouped into three key approaches: (1) Adding more capacity; (2) Increasing the efficiency of the existing facility; (3) Encouraging users to use the facility in less congestion-producing ways. As a traffic engineer, discuss **THREE (3)** strategies for each key approach, which you would consider in an effort to reduce traffic congestion in your city.

(18 marks)

Q4 (a) One of the most effective ways of controlling traffic at an intersection is the use of traffic signals. In order to decide on the installation of a traffic signal at an intersection, several conditions (warrants) must first be satisfied. Explain **FOUR (4)** of these conditions.

(12 marks)

(b) Figure **Q4** shows the layout and traffic demand in passenger car unit per hour (pcu/h) of a four-legged intersection that is to be upgraded to a signalised intersection using a 4-phased signal system. Table **1** shows the saturation flows and pedestrian volumes for the four approaches. The following information is also given:

All red interval = Not applicable
Yellow interval per phase = 4.0 sec
Lost time per phase = 3.5 sec
Desired critical volume-capacity ratio = 0.90
Average pedestrian speed = 1.22 m/s
Effective pedestrian crosswalk width = 2.75 m
Pedestrian crosswalk length = 14.0 m

Using the method proposed by the Highway Capacity Manual (HCM),

(i) Determine the actual green time for each phase.
(ii) Check to see if the minimum green times required for pedestrian crossing are satisfied or not.

(13 marks)

- END OF QUESTIONS -

S1 (a) Dengan bantuan graf dan rumus, bandingkan perkaitan antara laju dan ketumpatan trafik seperti yang dicadangkan oleh Greenshields (1934) dan Greenberg (1959).

(10 markah)

(b) Rajah **Q1** menunjukkan rajah masa-ruang yang diperolehi dari kajian aliran trafik yang melibatkan 6 buah kenderaan yang merentasi satu seksyen tak terganggu sepanjang 1 km di sebuah jalan arterial utama dalam jangkamasa 1 minit. Berpandukan rajah masa-ruang tersebut,

(i) Tentukan laju min masa dan laju min ruang.
(ii) Anggarkan kadar aliran, ketumpatan dan laju min bagi arus trafik tersebut.

(15 markah)

S2 (a) (i) Jelaskan bagaimana gelombang kejut dibentuk dalam trafik.
(ii) Sebutkan **DUA (2)** ciri gelombang kejut.
(iii) Nyatakan **EMPAT (2)** punca yang biasanya mengakibatkan kejadian gelombang kejut.

(10 markah)

(b) Satu arus trafik yang mempunyai kadar aliran 1,250 kenderaan/jam sedang bergerak pada kelajuan purata 54.3 km/jam di satu seksyen jalan utama luar bandar dua-lorong dalam arah menghala ke barat. Sebuah trak penghantaran barangan memasuki arus trafik tersebut pada kelajuan 25 km/jam. Trak tersebut bergerak sejauh 2 km sebelum meninggalkan jalan utama. Memandangkan kadar aliran trafik dalam arah bertentangan terlalu tinggi, kenderaan-kenderaan tidak mungkin dapat memotong trak tersebut. Akibatnya, kenderaan-kenderaan di belakang trak telah membentuk satu platun yang berketumpatan 60 kenderaan/km dengan kadar aliran 940 kenderaan/jam. Tentukan,

(i) Magnitud kelajuan gelombang kejut dan arah gelombang kejut tersebut.
(ii) Panjang platun tersebut dan bilangan kenderaan yang berada dalam platun sebelum trak meninggalkan jalan utama.

(15 markah)

S3 (a) Takrifkan "caj jalan". Sebutkan **DUA (2)** objektif utama caj jalan.

(3 markah)

(b) Pada pendapat anda, wajarkah caj jalan dilaksanakan di Malaysia? Berikan justifikasi untuk jawapan anda.

(4 markah)

(c) Strategi pengurusan kesesakan di fasiliti pengangkutan boleh dibahagikan kepada tiga pendekatan utama: (1) Menambahkan kapasiti; (2) Menambahkan keberkesanan fasiliti sedia ada; (3) Menggalakan pengguna menggunakan fasiliti dengan cara-cara yang kurang menghasilkan kesesakan. Sebagai seorang jurutera

trafik, bincangkan **TIGA (3)** strategi bagi setiap pendekatan utama, yang anda akan pertimbangkan dalam usaha untuk mengurangkan kesesakan lalu lintas di bandaraya anda.

(18 markah)

S4 (a) Salah satu daripada kaedah yang paling berkesan untuk mengawal trafik di persimpangan ialah dengan menggunakan isyarat trafik. Sebelum membuat keputusan bagi memasang isyarat trafik di persimpangan, beberapa syarat (waran) perlu dipenuhi terlebih dahulu. Jelaskan **EMPAT (4)** daripada syarat-syarat yang dimaksudkan itu.

(12 markah)

(b) Rajah **Q4** menunjukkan susunatur dan permintaan trafik dalam unit kenderaan penumpang sejam (ukp/jam) sebuah persimpangan empat-lengan yang bakal dinaiktaraf kepada sebuah persimpangan berlampu isyarat yang menggunakan sistem isyarat 3-fasa. Jadual **1** menunjukkan aliran tepu dan isipadu pejalan kaki bagi keempat-empat lengan tersebut. Maklumat lain adalah seperti berikut:

Selang semua merah = Tidak diaplikasi
Selang kuning setiap fasa = 4.0 saat
Masa hilang setiap fasa = 3.5 saat
Nisbah isipadu-kapasiti kritikal yang dikehendaki = 0.90
Purata kelajuan pejalan kaki = 1.22 m/s
Lebar efektif lintasan pejalan kaki = 2.75 m
Panjang lintasan pejalan kaki = 14.0 m

Dengan menggunakan kaedah yang disyorkan oleh "*Highway Capacity Manual*" (HCM),

(i) Tentukan masa hijau sebenar bagi setiap fasa.
(ii) Semak sama ada masa hijau minimum untuk pejalan kaki melintas jalan dipenuhi atau tidak.

(13 markah)

- SOALAN TAMAT -

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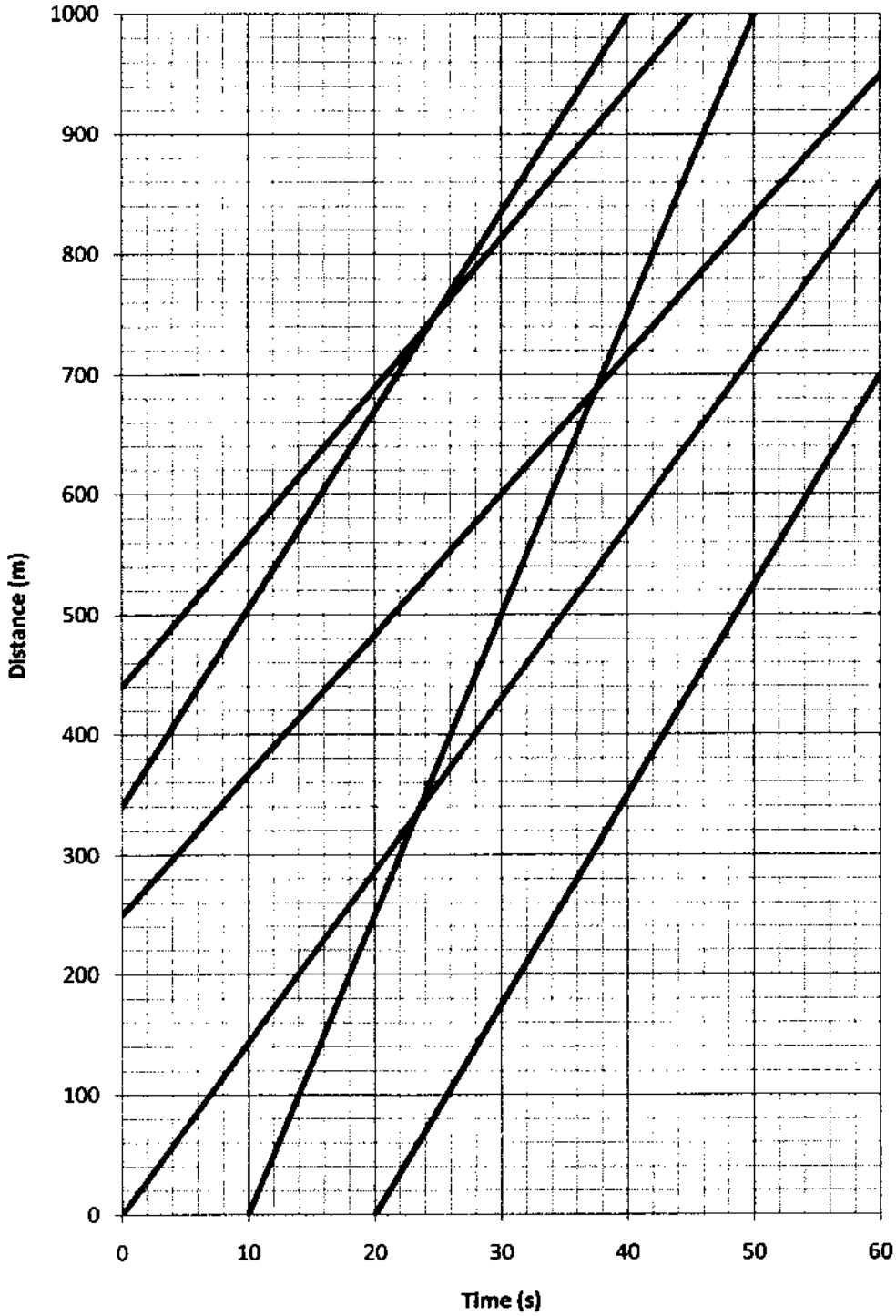

FIGURE Q1: Time-space diagram for traffic flow study on the major arterial road

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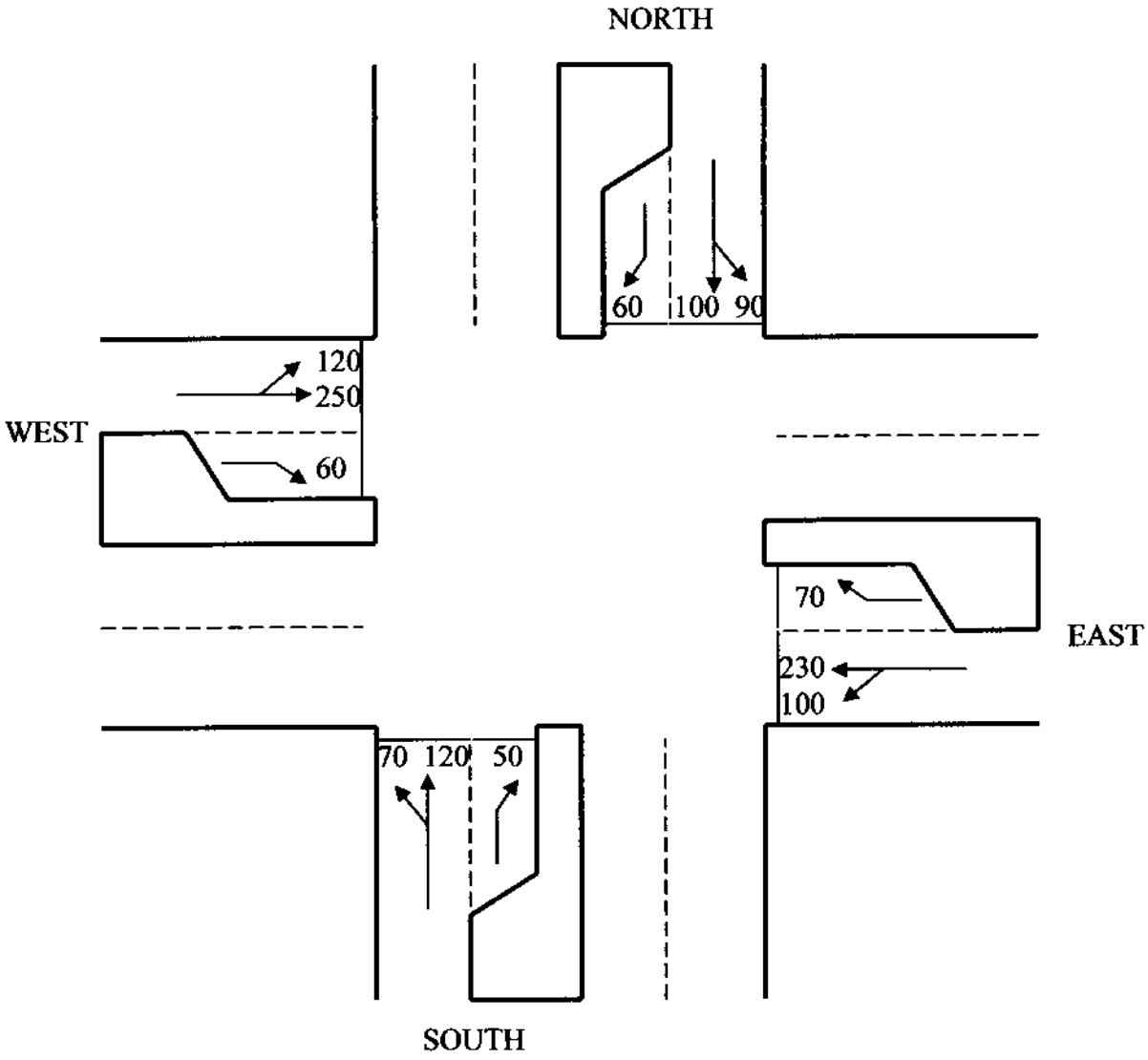

FIGURE Q4: Layout and traffic demand (pcu/h) of the four-legged intersection

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Table 1: Saturation flow and pedestrian volume on the approaches

Phase	1		2		3		4	
Approach	West		East		North		South	
Movement	Through/ Left	Right	Through/ Left	Right	Through/ Left	Right	Through/ Left	Right
Saturation Flow	1860	1100	1790	1050	1670	940	1750	920
Number of Pedestrians Crossing	35		20		25		30	

Note: The unit for saturation flow is pcu/hr while the unit for number of pedestrians crossing is pedestrians/interval/direction.

Equations that may be useful:

$$\tau_{\min} = \delta + \frac{W+L}{v_o} + \frac{v_o}{2a} \qquad C_o = \frac{1.5L+5}{1-Y} \qquad L = \sum l + R$$

$$G_e = \frac{y}{Y}(C-L) \qquad G_a = G_e + l - \tau \qquad G_p = 3.2 + \frac{L}{S_p} + \left(2.7\frac{N_{ped}}{W_E}\right)$$

$$G_p = 3.2 + \frac{L}{S_p} + \left(0.27N_{ped}\right) \qquad X_c = \sum\left(\frac{v}{s}\right)_c * \frac{C}{C-L}$$