UNIVERSITI SAINS MALAYSIA

Second Semester Examination
Academic Session 2004/2005

March 2005

EBS 419E/2 – Blasting Technology
[Teknologi Peletupan]

Duration: 2 hours
[Masa: 2 jam]

Please check that this examination paper consists of TWELVE pages of printed material and ONE page ANSWER SHEET For Objective Question before you begin the examination.

[Sila pastikan bahawa kertas peperiksaan ini mengandungi DUA BELAS muka surat bercetak dan SATU muka surat KERTAS JAWAPAN untuk soalan Objektif sebelum anda memulakan peperiksaan].

This paper contains 40 Objective questions and 3 Subjective questions.

[Kertas soalan ini mengandungi 40 soalan Objektif dan TIGA soalan Subjektif].

Instructions: Answer **ALL** Objective questions and any **TWO** Subjective questions.

[Arahan: Jawab **SEMUA** soalan Objektif dan mana-mana **DUA** soalan Subjektif].

Answer to any Subjective question must start on a new page. For the Objective type questions, make use of the answer sheet as provided in the Appendix.

[Mulakan jawapan anda untuk setiap soalan subjektif pada muka surat yang baru. Bagi soalan Objektif, gunakan kertas jawapan objektif yang disediakan dalam Lampiran].

All questions must be answered in English language. However, ONE question can be answered in bahasa Malaysia.

[Semua soalan mesti dijawab dalam bahasa Inggeris. Walau bagaimanapun, SATU soalan dibenarkan dijawab dalam bahasa Malaysia].

Attempt all questions in Question 1 (on the answer sheet in Appendix 1)

and any other two questions.

Jawap semua soalan dalam Soalan 1(di atas kertas jawapan di Lampiran 1)

dan mana-mana dua soalan yang lain.

1. 1.1 What is the burning speed of safety fuse?

   A. 120 s/m   C. 1 min/m
   B. 120 m/s   D. 200 m/s

1.1 Apakah kelajuan pembakaran fius keselamatan?

   A. 120 s/m   C. 1 min/m
   B. 120 m/s   D. 200 m/s

1.2 The velocity of detonation of detonating cord is ....

   A. 2 000 m/s   C. 4 000 m/s
   B. 3 000 m/s   D. 7 000 m/s

1.2 Halaju ledakan talian meledak ialah ....

   A. 2 000 m/s   C. 4 000 m/s
   B. 3 000 m/s   D. 7 000 m/s

1.3 A detonator is ....

   A. a blasting agent
   B. an explosive
   C. one of the explosives tool.
   D. the safety fuse

1.3 Detonator ialah ....

   A. agen peletupan
   B. suatu bahan letupan
   C. salah satu daripada peralatan bahan letupan.
   D. fius keselamatan.

1.4 Black powder is made up of .....

   I.   potassium nitrate
   II. charcoal
   III. sulphur
   IV. aluminium powder

   A. All of the above
   B. I, II and III
   C. I and II
   D. I and III

1.4 Serbuk hitam terdiri daripada ... ...

   I.   kalium nitrat
   II. arang
   III. sulfur
   IV. serbuk aluminium

   A. semua di atas
   B. I, II dan III
   C. I dan II
   D. I dan III

1.5 Gunpowder is a ....

   A. high explosive
   B. blasting agent
   C. low explosive
   D. safety fuse

1.5 Serbuk senapang ialah ....

   A. bahan letupan tinggi
   B. agen peletupan
   C. bahan letupan rendah
   D. fius keselamatan

1.6 Which of the following is ANFO?

   A. Ammonium nitrate and diesel
   B. Ammonium nitrate, fuel oil and TNT
   C. Ammonimum nitrate and PETN
   D. Ammonium nitrate and Sulphur.

1.6 Yang manakah seperti berikut ialah ANFO?

   A.. Ammonium nitrat dan disel
   B. Ammonium nitrat, minyak · pembakar dan TNT
   C. Ammonium nitrat dan PETN
   D. Ammonium nitrat dan sulfur

1.7 Which of the following are cap-sensitive explosives?

I. Gelignite
II. Watergel with non-explosive materials
III. Dynamite
IV. ANF0

A. All of the above
B. I and IV
C. I and III
D. II and IV

1.8 Capped fuse is ......

A. the safety fuse to which a plain detonator has been attached.
B. an electric detonator
C. shock tube with detonator.
D. a safety fuse hooked-up with detonating cord

1.9 Which of the following is the specific gravity of ANFO?

A. 1.3 to 1.6
B. 1.1 to 1.3
C. 1.2 to 1.4
D. 0.8 to 1.0

1.10 For maximum efficiency the ANFO mixture must be oxygen balanced and this requires a fuel oil content of ....

A. 2%   C. 6%
B. 4%   D. 8%

1.11 A plastic tube of an outside diameter of 3 mm and inside diameter of 2 mm, with inner surface coated with a reactive powder of cyclo-tetramethylene-tetranitrate (HMX) is the ....

A. detonating cord
B. safety fuse
C. shock tube
D. detonating tube

1.12 TNT is a high explosive which is the short form for ....

    A. tetranitrotoluene
    B. trinitrotoluene
    C. trunk-nitro-toluene
    D. total-nitro-toluene

1.12 TNT ialah bahan letupan tinggi dengan kependekkan untuk ....

    A. tetranitrotoluene
    B. trinitrotoluene
    C. trunk-nitro-toluene
    D. total-nitro-toluene

1.13 What is the approximate amount of high explosives in a No. 8 detonator?

    A. 1 gram   C. 6 grams
    B. 5 grams   D. 7 grams

1.13 Apakah anggaran berat bahan letupan yang terdapat di dalam detonator No. 8?

    A. 1 gram   C. 6 gram
    B. 5 gram   D. 7 gram

1.14 Detonating cord (also known as Cordtex) consists of a core of .... enclosed in a tape wrapping that is further bound by counter-laced textile yarn.

    A. TNT   C. RDX
    B. PETN   D. HMX

1.14 Talian meledak (juga dikenali sebagai Cordtex) terdiri daripada suatu teras .... yang dilitupi dalam bungkusan pita yang dibaluti lagi oleh bahan tekstil.

    A. TNT   C. RDX
    B. PETN   D. HMX

1.15 In surface blasting the rock is broken by the .... from the detonation of the explosives.

    A. tensile shock wave
    B. compressive shock wave
    C. vibration
    D. gas wave

1.15 Dalam peletupan di permukaan, batuan dipecahkan oleh .... daripada letupan bahan letupan.

    A. gelombang kejutan tegangan
    B. gelombang kejutan mampatan
    C. getaran
    D. gelombang gas

1.16 The detonating cord can be initiated by ....

    I. capped fuse
    II. electric detonator
    III. safety fuse
    IV. a match

    A. I and II
    B. I, II and III
    C. II and III
    D. IV only

1.16 Talian meledak boleh dimulakan dengan menggunakan ....

    I. fius bertutup
    II. detonator elektrik
    III. fius keselamatan
    IV. mancis api

    A. I dan II
    B. I, II dan III
    C. II dan III
    D. IV sahaja

1.17 The nonel tube can be initiated by ....

    I. a detonator
    II. safety fuse
    III. a match
    IV. a detonating cord

1.17 Tiub nonel boleh dimulakan dengan menggunakan ....

    I detonator
    II. fius keselamatan
    III. mancis api
    IV. talian meledak

A. All of the above
B. I and II
C. II and III
D. I and IV

1.18 Typically the resistance of an electric detonator is ......ohms.

A. 2   C. 6
B. 4   D. 8

1.18 Kebiasaannya   rintangan   suatu detonator elektrik ialah .... ohms.

A. 2   C. 6
B. 4   D. 8

1.19 In electric blasting, what is the recommended maximum number of detonators in a series circuit?

A. 10   C. 40
B. 30   D. 50

1.19 Dalam peletupan elektrik, apakah bilangan maksimum detonator yang disyorkan dalam litar siri?

A. 10   C. 40
B. 30   D. 50

1.20 In blasting using nonel initiation system, what is the maximum number of detonators required for detonation without misfires?

A. no limit   C. 40
B. 30   D. 50

1.20 Dalam peletupan yang menggunakan sistem permulaan nonel, apakah bilangan detonator maksimum yang diperlukan untuk peledakan tanpa salah cetus?

A. tiada had   C. 40
B. 30   D. 50

1.21 In electric blasting, the resistance of the circuit can be measured by using

....

A. a normal ohmmeter
B. a normal galvanometer as usually used by the electrician.
C. a blasting galvanometer
D. an ammeter

1.21 Dalam peletupan elektrik, rintangan litar boleh diukur dengan mengguna- kan ....

A. ohmmeter yang biasa
B. galvanometer biasa yang diguna- kan oleh juruelektrik.
C. galvanometer peletupan.
D. ammeter

1.22 To avoid misfires, each electric detonator must received a direct current of at least ....

A. 1.5 A   C. 2.0 A
B. 0.06 A   D. 4.0 A

1.22 Untuk menghindarkan salah cetus, setiap detonator hendaklah menerima suatu arus terus sekurang-kurangnya ....

A. 1.5 A   C. 2.0 A
B. 0.06 A   D. 4.0 A

1.23 In most blasting operation, series circuits are used. Parallel circuits are usually used in ....

A. underground mining
B. shaft sinking
C. the stopes
D. cautious blasting

1.23 Dalam setiap kegiatan peletupan, litar siri digunaka. Litar selari biasanya digunakan dalam ....

A. perlombongan bawah tanah
B. pengorekan syaf
C. rong
D. peletupan berjaga-jaga

1.24 Electric blasting must not be carried out in extraneous current of greater than ....

A. 1.5 A   C. 0.06 A
B. 2.0 A   D. 4.0 A

1.25 When an explosive column is initiated at a point, the full steady-state VOD is generally attained some distance away from that point. This distance is called the ....

A. detonation distance
B. ignition distance
C. burning distance
D. run-up distance

1.26 What will happen if lightning strike a blast area?

A. Nothing happen if nonel initiation system is being used.
B. Nothing happen if non-electrical initiation system is being used
C. Nothing happen if electronic initiation system is being used.
D. The charges will detonate prematurely.

1.27 What is stemming?

A. A tamping rod
B. The inert substance filled between the explosive and the blasthole collar.
C. The stem used in pushing the explosives into the blasthole.
D. The excess hole drilled to solve problem of toe.

1.28 The relation between burden (B) and diameter (D) of hole in surface blasting is .....

A. B = 10D to 20D
B. B = 15D to 30D
C. B = 25D to 40D
D. B = 30D to 50D

1.29 A contractor was blasting on a highway cut using a burden of 4.6m. 152 mm blastholes in sandstone rock were loaded with ANFO. The operator decided to reduce his blasthole size to 102 mm while still using ANFO as the explosive. What is the new burden?

    A. 6.85 m
    B. 3.09 m
    C. 2.5 m
    D. 7 m

1.29 Seorang kontraktor telah melakukan kerja peletupan di atas potongan lebuhraya dengan menggunakan beban 4.6 m. Lubang gerudi bergarispust 152 mm di dalam batu pasir telah diisi dengan ANFO. Pengendali telah emngambil keputusan untuk mengurangkan garispusat lubang letup kepada 102 mm dan masih menggunakan ANFO. Apakah beban yang baru?

    A. 6.85 m
    B. 3.09 m
    C. 2.5 m
    D. 7 m

1.30 Decoupling ratio is defined as ....

    A. ratio of a couple of explosive to the blasthole diameter.
    B. ratio of diameter of the explosive column to the diameter of the blasthole.
    C. ratio of blasthole diameter to the primer diameter.
    D. ratio of diameter of primer to the blasthole diameter.

1.30 Nisbah "decoupling" ditakrifkan sebagai ....

    A. nisbah dua bahan letupan kepada garispusat lubang gerudi.
    B. nisbah garispusat kolum bahan letupan kepada garispusat lubang gerudi.
    C. nisbah garispusat lubang gerudi kepada garispusat primer.
    D. nisbah garispusat primer kepada garispusat lubang gerudi.

1.31 The most expensive and inefficient blasting is the ....

    A. tunnel blasting
    B. primary blasting
    C. secondary blasting
    D. tertiary blasting

1.31 Peletupan yang paling mahal dan tidak cekap ialah ....

    A. peleteupan terowong
    B. peletupan primer
    C. peletupan sekunder
    D. peletupan tertiar

1.32 A series of closely spaced parallel holes are drilled at right angles to the tunnel face. All of these holes are charged except for the centre hole is one of the method to produce free face in tunnelling. This is the ....

    A. parallel blasting
    B. burn cut
    C. horizontal cut
    D. V-cut

1.32 Suatu siri lubang yang rapat serta selari antara satu sama lain digerudi serenjang dengan muka terowong. Semua lubang diisi dengan bahan letupan kecuali lubang yang di tengah untuk menghasilkan permukaan bebas. Dalam membuat terowong. Ini adalah ....

    A. peletupan selari
    B. potongan bakar
    C. potongan mendatar
    D. potongan V

1.33 Permitted explosives are used in underground ....

    A. coal mines
    B. metal mines

1.33 Bahan letupan "permitted" digunakan untuk .... bawah tanah

    A. lombong batu arang
    B. lombong logam

C. salt mines
D. tin mines

C. *lombong garam*
D. *lombong bijih timah*

1.34 A cooling agent such as .... is added to the composition of a permitted explosives to reduce the risk of ignition of gas or dust.

A. water
B. ice
C. sodium chloride
D. aerated water

1.34 Agen penyejukan seperti .... dicampurkan ke dalam komposisi bahan letupan "permitted" untuk mengurangkan risiko penyalaan gas atau habuk.

A. *air*
B. *ais*
C. *natrium klorid*
D. *air yang mengandungi udara.*

1.35 Short-hole blasting in underground mines is usually used in ....

A. breast stoping
B. sublevel stoping
C. shrinkage stoping
D. burn cut

1.35 Peletupan lubang pendek dalam lombong bawah tanah biasanya digunakan dalam ....

A. *pengerongan dada*
B. *pengerongan aras-sub*
C. *pengerongan kecutan*
D. *potongan bakar*

1.36 In tight blasting the following are used to prevent flyrock.

I.   blasting mat
II. wire netting
III. cushion blasting
IV. presplitting

A. III and IV
B. I and II
C. I, II and III
D. I and III

1.36 Dalam peletupan sempit, berikut dilakukan untuk menghindarkan batu terbang.

I.   *tikar peletupan*
II. *jaringan dawai*
III. *peletupam kusyen*
IV. *prarekahan*

A. *III dan IV*
B. *I dan II*
C. *I, II dan III*
D. *I dan III*

1.37 Explosives can be stored in a ....

A. store house
B. site office
C. safe building
D. magazine

1.37 Bahan letupan boleh disimpan di dalam ....

A. *rumah stor*
B. *pejabat lapangan*
C. *bangunan yang selamat*
D. *magazin*

1.38 Explosives products can be disposed of safely by ....

I.   detonation
II. burning
III. soaking in water
IV. leave them in open air to be desensitized.

1.38 Produk bahan letupan boleh di-musnahkan dengan selamat melalui ....

I.   *peledakan*
II. *pembakaran*
III. *direndam di dalam air*
IV. *biarkan di kawasan terbuka supaya ia menjadi tidak peka.*

A. I and II
B. I, II and III
C. III and IV
D. III only

1.39 The most successful and widely adopted controlled blasting method where it can create a plane of shear in the rock on the desired line of break is ....

A. line drilling
B. presplitting
C. cushion blasting
D. perimeter blasting

1.39 Kaedah peletupan kawalan yang paling berjaya dan meluas digunakan di mana cara ini boleh membentuk suatu satah ricih dalam batuan di atas garisan pecahan yang dikehendaki ialah ....

A. penggerudian garisan
B. prarekahan
C. peletupan kusyen
D. peletupan perimeter

1.40 The relationship used in estimating the vibration level (peak particle velocity) produced by blasting is ...., where W is the charge weight per delay, D is the distance from the blast, K and β are site constant.

A. $ppv = K\left(\dfrac{W}{\sqrt{D}}\right)^{-\beta}$

B. $ppv = W\left(\dfrac{K}{\sqrt{D}}\right)^{-\beta}$

C. $ppv = W\left(\dfrac{D}{\sqrt{K}}\right)^{-\beta}$

D. $ppv = K\left(\dfrac{D}{\sqrt{W}}\right)^{-\beta}$

1.40 Hubungan yang digunakan untuk membuat anggaran tahap gegaran (halaju zarah puncak) yang dihasilkan oleh peletupan ialah .... di mana W ialah berat bahan letupan per lengah, D ialah jarak daripada kawasan letupan, K dan β adalah pemalar lapangan.

A. $ppv = K\left(\dfrac{W}{\sqrt{D}}\right)^{-\beta}$

B. $ppv = W\left(\dfrac{K}{\sqrt{D}}\right)^{-\beta}$

C. $ppv = W\left(\dfrac{D}{\sqrt{K}}\right)^{-\beta}$

D. $ppv = K\left(\dfrac{D}{\sqrt{W}}\right)^{-\beta}$

(40 marks)   (40 markah)

2.   a.   Describe the initiation systems available for explosives.

(10 marks)

b.   What are the extraneous electricity hazards in blasting? Describe briefly each one of them.

(10 marks)

c.   What are the requirements to be considered for an explosive magazine?

(10 marks)

2.   a.   *Terangkan sistem permulaan yang terdapat bagi bahan letupan.*

(10 markah)

b.   *Apakah bahaya elektirk luaran dalam peletupan? Terangkan dengan ringkas bagi setiap satu daripadanya.*

(10 markah)

c.   *Apakah keperluan yang perlu dipertimbangkan bagi sebuah magazin bahan letupan?.*

(10 markah)

3.   a.   What is the difference between a primer and a booster?

(5 marks)

b.   Why is it the bottom hole initiation is better than the top hole initiation?

(5 marks)

c.   A new quarry is planned to produce 200,000 tonnes per month of granite. What is the amount of explosive to be stored in a magazine to have a stock of explosives for a month production. Assuming that the powder factor for granite is 0.7 kg/m^3 and its specific gravity of 2.6.

(5 marks)

    d.   Write a short note on controlled blasting.

                  (15 marks)

3.   a.   *Apakah perbezaannya di antara primer dan booster?*

                  (5 markah)

    b.   *Kenapakah memulakan ledakan di bawah lubang lebih baik daripada memulakan ledakan di atas lubang?*

                  (5 markah)

    c.   *Sebuah kuari baru dirancang akan mengeluarkan 200,000 tan metrik batuan granite salam sebeluan. Apakah amaun bahan letupan yang perlu disimpan di dalam magazin untuk menyimpan bahan letupan yan gmencukupi pengeluaran untuk sebulan. Andaikan faktor serbuk bagi granit ialah 0.7 kg/m3 dan graviti tentunya sebagai 2.6.*

                  (5 markah)

    d.   *Tuliskan nota ringkas mengenai peletupan terkawal.*

                  (15 markah)

4.   a.   Describe briefly how blasting is achieved in tunnelling

                  (10 marks)

    b.   A quarry has been designed to use 12 m benches and 85 mm blastholes. A pre-production ground vibration survey gave the following results:-

Test No.	Distance, m	Charge weight, kg	Peak Particle Velocity, mm/s
1	50	4	15.1
2	50	8	24.3
3	75	4	8.4
4	75	8	13.6
5	150	4	1.5
6	150	8	4.0

Using USBM formula, determine:-

i.   the site constant

ii.   the level of vibration which would be experienced at a private building sited 450 m away from a production blast of two hole per delay. Comment on this result and outline any changes which you would make to the blast design, given that the specific gravity of the explosive is 1.20. The Department of Mineral and Geoscience has specified that a vibration level of 5 mm/s must not be exceeded at any dwelling house or private buliding.

(20 marks)

4.   a.   *Terangkan dengan ringkas bagaimanakah peletupan dilakukan dalam penerowongan.*

(10 markah)

b.   *Sebuah kuari telah direkabentuk untuk menggunakan undak 12 m dan lubang letup 85 mm. Pengukuran gegaran bumi telah dibuat sebelum pengeluaran dengan keputusan seperti berikut:-*

No. rujukan. Ujian	Jarak, m	Berat bahan letupan, kg	Halaju zarah puncak, mm/s
1	50	4	15.1
2	50	8	24.3
3	75	4	8.4
4	75	8	13.6
5	150	4	1.5
6	150	8	4.0

Dengan menggunakan formula USBM, tentukan:-

i.   *pemalar lapangan.*

ii.   *tahap gegaran yang dijangka akan dialami di sebuah bangunan persendirian yang terletak 450 m daripada suatu peletupan dengan dua lubang per lengah. Komen keputusan yang diperolehi dan terangkan apa-apa pertukaran yang perlu anda lakukan ke atas rekabentuk peletupan, diberi bahawa graviti tentu bahan letupan ialah 1.20. Jabatan Mineral dan Geosains telah menetapkan bahawa gegaran tidak boleh melebihi 5 mm/s di mana-mana rumah tempat tinggal atau bangunan persendirian.*

(20 markah)

UNIVERSITI SAINS MALAYSIA

SECOND SEMESTER EXAMINATION 2004/2005
PEPERIKSAAN SEMESTER KEDUA 2004/2005

EBS 419E/2
BLASTING TECHNOLOGY
TEKNOLOGI PELETUPAN

OBJECTIVE QUESTIONS ANSWER SHEET

Examination Index Number :
Angka Giliran Peperiksaan:
(in words):
(dalam perkataan):

....

....

Blacken the correct answer using any suitable pencil.

1.1	=A=	=B=	=C=	=D=	1.21	=A=	=B=	=C=	=D=
1.2	=A=	=B=	=C=	=D=	1.22	=A=	=B=	=C=	=D=
1.3	=A=	=B=	=C=	=D=	1.23	=A=	=B=	=C=	=D=
1.4	=A=	=B=	=C=	=D=	1.24	=A=	=B=	=C=	=D=
1.5	=A=	=B=	=C=	=D=	1.25	=A=	=B=	=C=	=D=
1.6	=A=	=B=	=C=	=D=	1.26	=A=	=B=	=C=	=D=
1.7	=A=	=B=	=C=	=D=	1.27	=A=	=B=	=C=	=D=
1.8	=A=	=B=	=C=	=D=	1.28	=A=	=B=	=C=	=D=
1.9	=A=	=B=	=C=	=D=	1.29	=A=	=B=	=C=	=D=
1.10	=A=	=B=	=C=	=D=	1.30	=A=	=B=	=C=	=D=
1.11	=A=	=B=	=C=	=D=	1.31	=A=	=B=	=C=	=D=
1.12	=A=	=B=	=C=	=D=	1.32	=A=	=B=	=C=	=D=
1.13	=A=	=B=	=C=	=D=	1.33	=A=	=B=	=C=	=D=
1.14	=A=	=B=	=C=	=D=	1.34	=A=	=B=	=C=	=D=
1.15	=A=	=B=	=C=	=D=	1.35	=A=	=B=	=C=	=D=
1.16	=A=	=B=	=C=	=D=	1.36	=A=	=B=	=C=	=D=
1.17	=A=	=B=	=C=	=D=	1.37	=A=	=B=	=C=	=D=
1.18	=A=	=B=	=C=	=D=	1.38	=A=	=B=	=C=	=D=
1.19	=A=	=B=	=C=	=D=	1.39	=A=	=B=	=C=	=D=
1.20	=A=	=B=	=C=	=D=	1.40	=A=	=B=	=C=	=D=