UNIVERSITI TUN HUSSEIN ONN MALAYSIA

PEPERIKSAAN AKHIR
SEMESTER II
SESI 2008/2009

NAMA MATA PELAJARAN	:	MEKANIK TANAH
KOD MATA PELAJARAN	:	BBT 3432
KURSUS	:	SARJANA MUDA PENDIDIKAN TEKNIK DAN VOKASIONAL
TARIKH PEPERIKSAAN	:	APRIL 2009
JANGKA MASA	:	2 JAM
ARAHAN	:	JAWAB EMPAT SOALAN SAHAJA

KERTAS SOALAN INI MENGANDUNGI 12 MUKA SURAT

S1   *A sample of soil at its natural state weights 30.4kg and a volume of 0.0184m³.
After oven dried, its weight was reduced about 3kg. The specific gravity of the
solids was found to be 2.68. Determine the following:*
    (a)   bulk density
    (b)   dry density
    (c)   dry unit weight
    (d)   percentage of moisture content
    (e)   saturated density
    (f)   void ratio
    (g)   porosity
    (h)   degree of saturation

(25 marks)

S1   Satu contoh tanah dalam keadaan asal mempunyai berat 30.4kg dan isipadu
0.0184m³. Selepas dikeringkan dalam ketuhar, beratnya berkurangan sebanyak
3kg. Graviti tentu zarah diberi 2.68. Tentukan:
    (a)   ketumpatan gembur
    (b)   ketumpatan kering
    (c)   berat unit kering
    (d)   peratus kandungan lembapan
    (e)   ketumpatan tepu
    (f)   nisbah lompang
    (g)   keliangan
    (h)   darjah ketepuan

(25 markah)

S2   *(a)*   *What is a definition of*
                 (i)   Effective Size (D_{10})
                 (ii)   Plastic Limit.

(3 marks)

    (b)   *The results of a sieve analysis of a soil sample are shown in Table S2.*

                 (j)   Find value of A, B and C

(3 marks)

                 (ii)   Plot the particles size distribution curve of the soil sample.

(3 marks)

                 (iii)   Classify the soil using;
                        a.   The Unify Soil Classification System (USCS).
                        b.   The American Association of State Highway and Traffic Official (AASHTO)

(16 marks)

S2   (a)   Berikan definisi :
                 (i)   Saiz Berkesan D_{10}
                 (ii)   Had Plastik

(3 markah)

    (b)   Keputusan analisis ayakan bagi satu contoh tanah ditunjukkan dalam Jadual S2.

                 (i)   Cari nilai A, B dan C

(3 markah)

                 (ii)   Lukis graf taburan saiz zarah bagi tanah tersebut.

(3 markah)

                 (iii)   Kelaskan tanah tersebut dengan menggunakan ;
                        a.   Sistem Pengkelasan Tanah Bersekutu (USCS).
                        b.   Pertubuhan America bagi Jalanraya dan Lalulintas Negeri. (AASHTO)

(16 markah)

Table S2

Sieve Size (mm)	Weight Retained (g)	Percentage Passing (%)
10	0.0	100
6	7.5	95
2	33	A
1	30.75	52.5
0.6	B	32
0.3	21.75	17.5
0.15	15	7.5
0.063	3.75	C
0.02	4.5	2
Pan	3	0
Plastic Limit	35 %	
Liquid Limit	42 %	

S3   *A series of consolidated undrained tests with pore water pressure measurement on a sample of saturated clay gave the results as in Table S3. Find the values of the apparent cohesion C and the angle of shearing resistance ø ;*

    (a)   with respect to total stress.
    (b)   with respect to effective stress

(25 marks)

S3   Satu siri ujikaji terkukuh tak tersalir dengan pengukuran tekanan air liang ke atas satu sampel tanah liat tepu memberikan keputusan seperti dalam Jadual S3. Cari nilai-nilai bagi kejelekitan ketara, c dan sudut rintangan ricih, ø ;

    (a)   dalam bentuk tegasan jumlah
    (b)   dalam bentuk tegasan berkesan

(25 markah)

Table S3

All-round pressure (kN/m^2)	Principal stress difference, (kN/m^2)	Pore water pressure, (kN/m^2)
150	192	80
300	341	154
450	504	222

S4 (a) Give the definition of 'Permeability Coefficient of Soil'.

(5 marks)

(b) A test was carried out in a laboratory by using a constant head permeameter on a sandy soil. The length of the sample was 250mm and 2000mm^2 in area. With a head lost of 500mm, the discharge was found to be 260ml in 130seconds. Determine the permeabiltiy coefficient of the soil.

(10 marks)

(c) If the specific gravity of the grains was 2.62 and the dry weight of the soil 916g, find the void ratio of the sample.

(10 marks)

S4 (a) Beri definisi 'Pekali Ketelapan Tanah'.

(5 markah)

(b) Satu ujikaji telah dijalankan dalam makmal menggunakan turus tekanan tetap pada sampel tanah berpasir. Panjang sampel 250mm dan luas 2000mm^2. Kehilangan turus adalah 500mm dan kadar alir ialah 260ml dalam masa 130 saat. Tentukan pekali kebolehtelapan tanah tersebut.

(10 markah)

(c) Jika graviti tentu bagi zarah tanah itu ialah 2.62 dan jisim kering tanah ialah 916g, tentukan nilai bagi liang tanah tersebut.

(10 markah)

S5   *(a)*   *State the factors of slope failures.*

(5 marks)

(b)   *With a suitable sketches, explain how the slip failurse occur?*

(8 marks)

(c)   *A project of highway will be construct at highland area involving the cutting and filling work. With a suitable diagrams, explain two types of slope stability used for soil structure stability.*

(12 marks)

S5   (a)   Nyatakan faktor-faktor yang menyebabkan kegagalan cerun berlaku.

(5 markah)

(b)   Berbantukan lakaran, jelaskan dengan ringkas bagaimana geliciran berlaku pada cerun.

(8 markah)

(c)   Satu projek jalanraya akan dibina di kawasan tanah tinggi yang melibatkan kerja-kerja pemotongan dan penambakan tanah. Dengan berbantukan rajah huraikan bagaimana dua kaedah penstabilan cerun dapat memberi kesan kepada kestabilan struktur tanah.

(12 markah)

S6   Standard Proctor compaction test carried out on a sample of soil shows a results in Table S6.

(a)   Given:

$$\rho_d = \frac{2700}{1 + 2.7m}$$

Plot the line of zero air voids.

(5 marks)

(b)   Plot the curve of dry density against moisture content and find the values of optimum moisture content and maximum dry density.

(8 marks)

(c)   What are the values of void ratio, porosity and the degree of saturation of the soil at its condition of optimum moisture content?

(12 marks)

S6   Ujian piawai pemadatan Proctor ke atas sejenis tanah memberikan keputusan-keputusan seperti dalam Jadual S6.

(a)   Diberi:

$$\rho_d = \frac{2700}{1 + 2.7m}$$

Lukiskan garis 'zero air voids'.

(5 markah)

(b)   Plotkan graf ketumpatan kering melawan kandungan lembapan dan dapatkan nilai bagi kandungan lembapan optimum dan ketumpatan kering maksimum.

(8 markah)

(c)   Apakah nilai bagi nisbah liang, kelompangan dan darjah ketepuan bagi tanah tersebut pada keadaan di mana kandungan lembapan adalah optimum?

(12 markah)

Table S6

| Moisture content, (%)	5	8	10	12	15	20
Bulk density, (kg/m³)	1890	2140	2202	2220	2160	2070
Given; Specific gravity, $G_s = 2.7$						

S7   (a)   *Rock influence topography, economic activity and residential pattern form. State what those characteristics is consider in rock classification.*

(3 markah)

(b)   *Give 3 groups of rock. Describe the formation process for every rock groups stated.*

(9 markah)

(c)   *Describe how rock classification able to contribute economy's growth.*

(13 markah)

S7   (a)   Batuan mempengaruhi bentuk muka bumi, kegiatan ekonomi dan corak penempatan. Nyatakan apakah ciri-ciri yang diambil kira dalam pengkelasan batuan.

(3 markah)

(b)   Berikan 3 kumpulan batuan. Huraikan proses pembentukan untuk setiap kumpulan batuan yang dinyatakan.

(9 markah)

(c)   Huraikan bagaimana pengkelasan batuan dapat menyumbang kepada peningkatan ekonomi negara.

(13 markah)

General classification	Granular materials (35 percent or less of total sample passing no. 200)							Silt-clay Materials (More than 35 percent of total sample passing no. 200)			
Group classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5* A-7-6
Sieve analysis percent passing											
# 10	50 max										
# 40	30 max	50 max	51 min								
# 200	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing # 40											
Liquid limit, w_L				40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plastic index, I_P	6 max		NP	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min
Group index	0		0	0		4 max		8 max	12 max	16 max	20 max

Group index = GI = $0.2a + 0.005ac + 0.01bd$

(a) AASHO soil classification system.
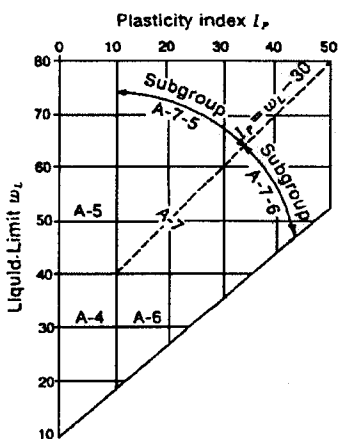
(b) Liquid limit and plasticity index ranges for A-4, A-5, A-6, and A-7 soil groups
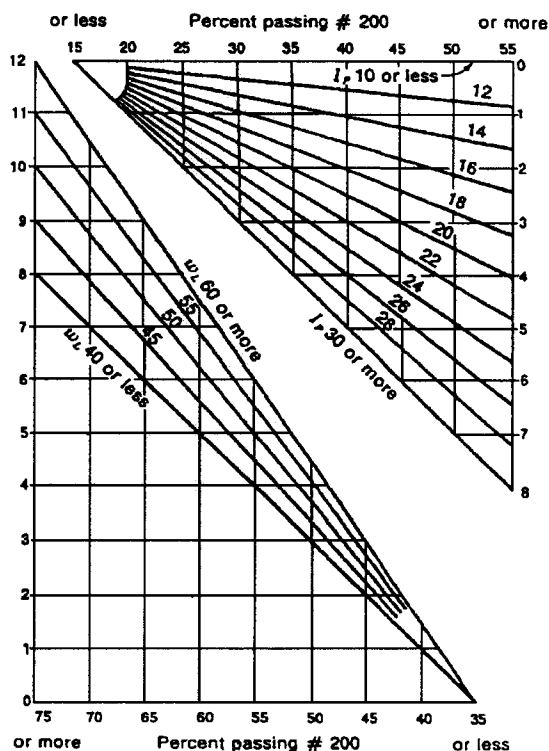
(c) Chart to obtain group index of a soil

$$G.I. = \underbrace{(F-35)}_{a}\left[0.2 + \underbrace{0.005(L.L.-40)}_{b}\right] + 0.01\underbrace{(F-15)}_{c}\underbrace{(P.I.-10)}_{d}$$

American Association of State Highway and Traffic Official (AASHTO)
(Persatuan Jalanraya dan Lalulintas Negeri-negeri Amerika Syarikat)

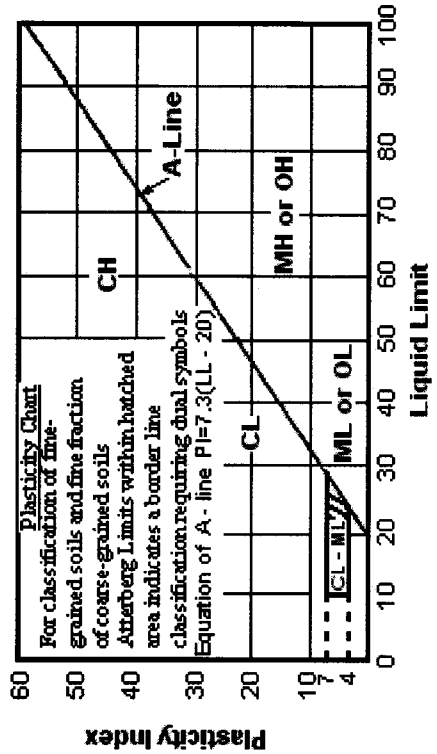| TABLE 4-5 APPROXIMATE EQUIVALENT GROUPS OF AASHTO AND UNIFIED SOIL CLASSIFICATION SYSTEMS	
AASHTO	Unified
A-2-6	GC, SC
A-2-7	GC, SC
A-3	SP
A-4	ML, OL
A-5	MH
A-6	CL
A-7-5	CL, OL
A-7-6	CH, OH

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MAJOR DIVISION			GROUP SYMBOLS	TYPICAL NAMES	CLASSIFICATION CRITERIA
COARSE-GRAINED SOILS More than 50% retained on 0.075 mm (No. 200) sieve	**GRAVELS** 50% or more of coarse fraction retained on 4.75 mm (No.4) sieve	**CLEAN GRAVELS**	GW	Well-graded gravels and gravel-sand mixtures, little or no fines	$C_u = D_{60}/D_{10}$ — Greater than 4 $C_c = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$ — Between 1 and 3
			GP	Poorly graded gravels and gravel-sands mixture, little or no fines	Not meeting both criteria for GW
		GRAVELS WITH FINES	GM	Silty gravels, gravel-sands - silt mixture	Atterberg limit plot below "A" line or Plasticity Index less than 4
			GC	Clayey gravels, gravel-sands-clay mixture	Atterberg limit plot above "A" line and Plasticity Index greater than 7
	SANDS More than 50% of coarse fraction passes 4.75 mm (No.4) sieve	**CLEAN SANDS**	SW	Well-graded sands and gravelly sands, little or no fines	$C_u = D_{60}/D_{10}$ — Greater than 6 $C_c = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$ — Between 1 and 3
			SP	Poorly graded sands and gravelly sands, little or no fines	Not meeting both criteria for SW
		SANDS WITH FINES	SM	Silty sands, sand-silt mixtures	Atterberg limit plot below "A" line or Plasticity Index less than 4
			SC	Clayey sands, sand-clay mixture	Atterberg limit plot above "A" line and Plasticity Index greater than 7
FINE-GRAINED SOILS 50% or more passing 0.075 mm (No.200) sieve	50% or less Liquid Limit		ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands	
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	
			OL	Organic silts and organic silty clays of low plasticity	
	Liquid Limit greater than 50%		MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts	
			CH	Inorganic clays of high plasticity, fat clays	
			OH	Organic clays of medium to high plasticity	
Highly Organic Soils			PT	Peat, muck and other highly organic soils	

Classification on basis of percentage of fines

Less than 5% Pass 0.075 mm sieve   GW, GP, SW, SP

More than 12% Pass 0.075 mm sieve   GM, GC, SM, SC

5% to 12% Pass 0.075 mm sieve   Border Classifica-tion requiring use of dual symbols

Plasticity Chart

For classification of fine-grained soils and fine fraction of coarse-grained soils

Atterberg Limits within hatched area indicates a border line classification requiring dual symbols

Equation of A - line PI=7.3(LL - 20)

Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols

Visual-Manual Identification, See ASTM Designation D 2488

<u>Unified Soil Classification System (USCS)</u>

(Sistem Pengkelasan Tanah Bersekutu)

Nama.. No. Matrik :................................

TABURAN SAIZ ZARAH

(Empty particle size distribution chart with axes)

Horizontal axis (top): 60, 20, 10, 6, 2, 1, 0.6, 0.2, 0.1, 0.06, 0.02, 0.01, 0.006, 0.002, 0.001

Vertical axis: JUMLAH PERATUS LULUS (%) — 100, 90, 80, 70, 60, 50, 40, 30, 20, 10, 0

Classification columns:
- AYAKAN
  - KELIKIR: KASAR, SEDERHANA, HALUS
  - PASIR: KASAR, SEDERHANA, HALUS
- HYDROMETER
  - KELODAK: KASAR, SEDERHANA, HALUS