



**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
SEMESTER II  
SESSION 2010/2011**

COURSE NAME : ELECTRICAL POWER  
EQUIPMENT

COURSE CODE : DEZ 3213

PROGRAMME : 3 DET

EXAMINATION DATE : APRIL/MAY 2011

DURATION : 2½ HOURS

INSTRUCTIONS : ANSWER **FOUR (4)** QUESTIONS  
ONLY

THIS QUESTION PAPER CONSISTS OF FIVETEEN (15) PAGES

**SOALAN DALAM BAHASA MALAYSIA**

**S1** (a) Untuk perlindungan diri semasa bekerja dengan pengalir dan/atau peralatan elektrik, semua peranti pemencil yang dibuka mestilah dikunci. Label 'BAHAYA' mestilah diletakkan pada peranti pemencil tersebut.

- i) Namakan tiga (3) jenis label 'BAHAYA'.
- ii) Huraikan penggunaannya.

(9 markah)

(b) Sebelum menggunakan sarung tangan getah, pemeriksaan visual dan ujian pengudaraan mestilah dilakukan sekurang-kurangnya sekali setiap hari dan juga sekiranya perlu ketika kerja sedang dilakukan. Huraikan bagaimana pemeriksaan/ujian berikut dilakukan:

- i) Pemeriksaan visual.
- ii) Ujian pengudaraan.

(5 Markah)

(c) Lengkapkan jadual kesan kejutan elektrik keatas manusia yang disebabkan oleh kadaran arus merujuk kepada Jadual S1(c).

(11 Markah)

**S2** (a) Huraikan dengan jelas tujuan ujian dibawah:

- i) Ujian Penerimaan.
- ii) Ujian Penyenggaraan Rutin.
- iii) Ujian Penyenggaraan Khas.

(9 Markah)

(b) Senaraikan dua (2) jenis ujian arus terus untuk perkakas suis dan pemutus litar elektrik.

(4 Markah)

(c) Dengan merujuk kepada Rajah S2(c)i dan S2(c)ii, lukiskan sambungan pengujian untuk pengubah satu (1) fasa bagi ujian berikut:

- i) Belitan voltan tinggi ke belitan voltan rendah dan bumi.
- ii) Belitan voltan rendah ke bumi.

(6 Markah)

(d) Dengan merujuk kepada Rajah S2(d)i dan S2(d)ii, lukiskan sambungan pengujian untuk pengubah tiga (3) fasa bagi ujian berikut:

- i) Belitan voltan tinggi ke bumi dengan belitan voltan rendah ke pelindung.
- ii) Belitan voltan rendah ke bumi dengan belitan voltan tinggi ke pelindung.

(6 Markah)

**S3** (a) Jadual S3(a) menunjukkan jadual pengujian faktor kuasa bagi pengubah dua (2) belitan. Lukiskan sambungan pengujian bagi:

- i) Ujian nombor dua (2) - Rujuk Rajah S3(a)i.
- ii) Ujian nombor empat (4) – Rujuk Rajah S3(a)ii.

(6 Markah)

(b) Dengan bantuan gambarajah, terangkan konsep penyejukan daya air bagi sistem penyejukan pengubah.

(6 Markah)

(c) Senaraikan enam (6) kaedah pengujian rutin bagi sesebuah pengubah di lapangan.

(6 Markah)

(d) Dengan bantuan gambarajah, terangkan prosedur ujian keterusan untuk pengubah satu (1) fasa menggunakan lampu filamen 100W.

(7 Markah)

- S4** (a) Rajah S4(a) merupakan kabel bersepusat neutral, namakan setiap bahagian bagi kabel tersebut.
- (6 Markah)
- (b) Terangkan tiga (3) jenis bahan yang digunakan untuk penempatan kabel.
- (6 Markah)
- (c) Kirakan tegangan tarikan yang diperlukan untuk menarik tiga (3) kabel kuprum, 500 V, berat bersih per kaki ialah 0.55 lbs, berpenambat PVK, dalam saluran seperti di Rajah S4(c). Anggap pekali geseran = 0.5 (pada semua keadaan saluran dinding). Rujuk Jadual S4(c) untuk faktor pengganda bagi bengkokan bersudut.
- (13 Markah)
- S5** (a) Dengan bantuan gambarajah, terangkan bagaimana untuk mengesan kerosakan kabel bawah tanah dengan menggunakan Kaedah Kecerunan Voltan.
- (10 Markah)
- (b) Senaraikan tiga (3) jenis pemutus litar voltan rendah.
- (3 Markah)
- (c) Senaraikan empat (4) jenis ujian penyenggaraan bagi pemutus litar kotak teracu.
- (4 Markah)
- (d) Sebuah termograf mengesan suhu panas yang abnormal pada sebuah pemutus litar berkadaran 100 A. Juruteknik mendapati beban pada pemutus litar adalah sebanyak 30 A. Termograf juga mendapati suhu persekitaran adalah 20<sup>0</sup> C dan bahagian yang paling panas di pemutus litar adalah pada tamatan cuping bahagian beban fasa C iaitu 31<sup>0</sup> C. Tentukan samada pemutus litar ini bekerja pada suhu yang dibenarkan oleh spesifikasi ataupun tidak. Rujuk Jadual S5(d) sebagai rujukan suhu piawai bagi pemutus litar.
- (8 Markah)

- S6** (a) Terangkan empat (4) kelas sistem penebatan yang digunakan untuk belitan mesin.  
(8 Markah)
- (b) Galas pada mesin elektrik mestilah diperiksa dengan teliti mengikut jadual masa yang telah ditentukan bagi memastikan jangka hayat yang panjang. Senaraikan empat (4) sebab yang boleh menyebabkan galas menjadi panas.  
(4 Markah)
- (c) Senaraikan empat (4) kaedah pengukuran rintangan bumi.  
(4 Markah)
- (d) Takrifkan maksud 'pembumian'.  
(3 Markah)
- (e) Terangkan tiga (3) tanda kemerosotan pada belitan angker yang boleh didapati menggunakan kaedah pemeriksaan visual.  
(6 Markah)

**QUESTIONS IN ENGLISH**

**Q1** (a) For the protection of personnel working on electrical conductor and/or equipment, locks must be placed on all open isolation devices. 'DANGER' tags must also be placed on the open isolation device.

- i) Name three (3) 'DANGER' tags.
- ii) Explain its usage.

(9 Marks)

(b) Before rubber gloves are used, a visual inspection and an air test should be made at least once every day and at any other time deemed necessary during the progress of the job. Explain how to conduct the following inspection/test:

- i) the visual inspection.
- ii) an air test.

(5 Marks)

(c) Refer to Table Q1(c), relate the effect of an electrical shock on an average human by the given current ratings.

(11 Marks)

**Q2** (a) Explain in details the purposes of the test below:

- i) Acceptance Test.
- ii) Routine Maintenance Test.
- iii) Special Maintenance Test.

(9 Marks)

(b) List two (2) types of dc testing for electrical switchgear and circuit breakers.

(4 Marks)

(c) For the diagram in Figure Q2(c)i and Q2(c)ii, draw the testing connection of a single (1) phase transformer for the following tests:

- i) High voltage winding to low voltage winding and ground.
- ii) Low voltage winding to ground.

(6 Marks)

- (d) For the diagram in Figure Q2(d)i and Q2(d)ii, draw the testing connection of a three (3) phase transformer for the following tests:
- i) High voltage winding to ground with low voltage winding to guard.
  - ii) Low voltage winding to ground with high voltage winding to guard.
- (6 Marks)
- Q3** (a) Table Q3(a) showed a power factor tests for two (2) winding transformer. Draw the testing connection for:
- i) Test number two (2) - Refer Figure Q3(a)i.
  - ii) Test number four (4) - Refer Figure Q3(a)ii.
- (6 Marks)
- (b) With the aid of a drawing, explain the concept of forced water cooled for transformer cooling system.
- (6 Marks)
- (c) List six (6) test methods which routinely conducted in the field on the transformer.
- (6 Marks)
- (d) With the aid of drawing, explain the test procedures for single (1) phase transformer continuity check using a 100 W filament lamp.
- (7 Marks)
- Q4** (a) Named each parts of the concentric neutral cable referred to Figure Q4(a).
- (6 Marks)
- (b) Explain three (3) types of materials used for cable insulation.
- (6 Marks)

- (c) Determine the pull tension required to pull three (3) copper cable, 500 V, net weight per foot is 0.55 lbs, PVC jacketed cable, in a horizontal duct as shown in Figure Q4(c). Assume coefficient of friction = 0.5 (on all condition of duct wall). Refer to Table Q4(c) for multiplying factor of angle bend.
- (13 Marks)
- Q5** (a) With the aid of diagram, explain how to localize the underground cable fault using Voltage Gradient Method.
- (10 Marks)
- (b) List three (3) types of low voltage circuit breakers.
- (3 Marks)
- (c) List four (4) types of maintenance test for moulded case circuit breakers.
- (4 Marks)
- (d) A thermographer has located an abnormally warm 100 A circuit breaker. The technician measures a load of 30 A on the circuit breaker. The thermographer measures an ambient air temperature of 20<sup>0</sup> C and determines that hottest part of the circuit breaker, the terminal lug on the load side of phase C, is 31<sup>0</sup> C. Determine whether this circuit breaker is running within temperature specification or not. Refer Table Q5(d) for circuit breaker standard temperature.
- (8 Marks)
- Q6** (a) Explain four (4) classes of insulation systems used for machine windings.
- (8 Marks)
- (b) The bearings of electrical machine should be carefully inspected at scheduled periodic intervals in order to obtain maximum life. List four (4) causes which can produce hot bearings.
- (4 Marks)
- (c) List four (4) grounding resistance measurement methods.
- (4 Marks)



(d) Define the term of 'grounding'.

(3 Marks)

(e) Explain three (3) signs of deterioration at armature windings which can be spot by using visual inspection method.

(6 Marks)

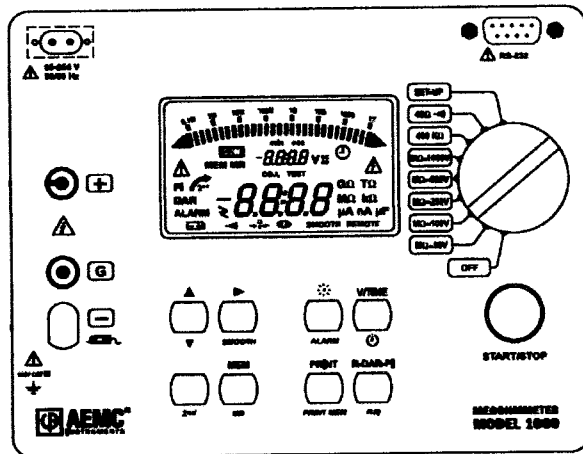
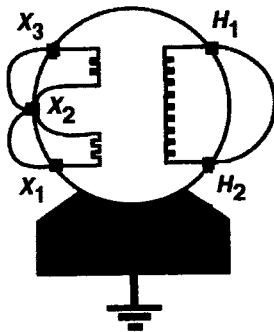
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**JADUAL S1(c) / TABLE Q1(c) : Effects of current on an average human.**

Current values through body trunk	Effect
1 mA or less	
1 – 8 mA	
8 – 15 mA	
15 – 20 mA	
20 – 50 mA	
50 – 200 mA	
200 mA and over	

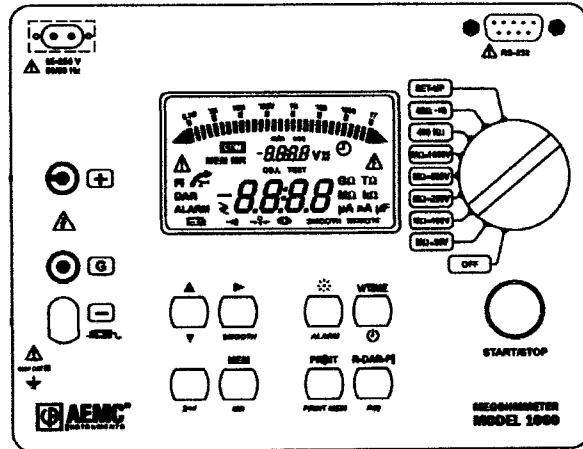
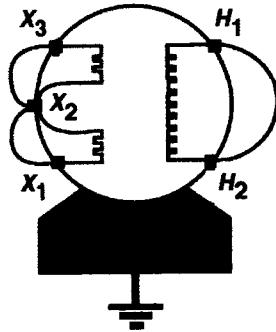


**RAJAH S2(c)i / FIGURE Q2(c)i : High voltage winding to low voltage winding and ground.**

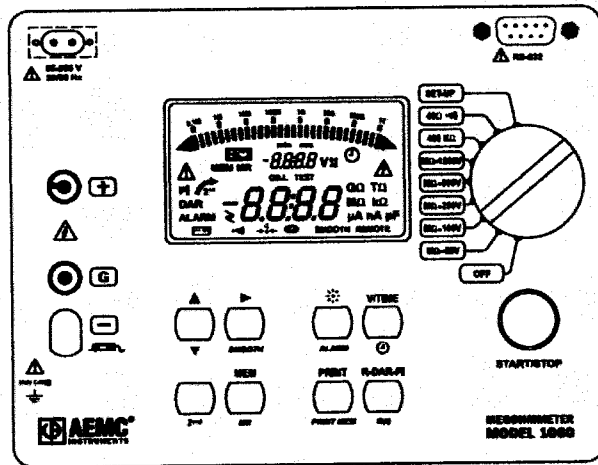
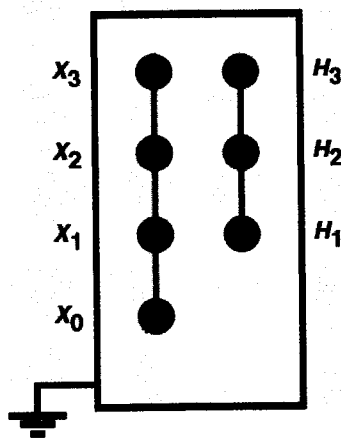
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**RAJAH S2(c)ii / FIGURE Q2(c)ii** : Low voltage winding to ground.

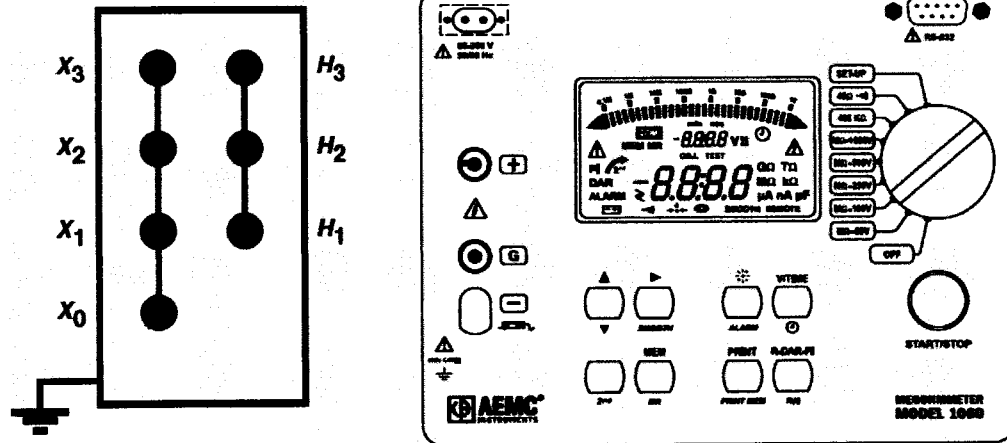


**RAJAH S2(d)i / FIGURE Q2(d)i** : High voltage winding to ground with low voltage winding to guard.

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**RAJAH S2(d)ii / FIGURE Q2(d)ii :** Low voltage winding to ground with high voltage winding to guard.

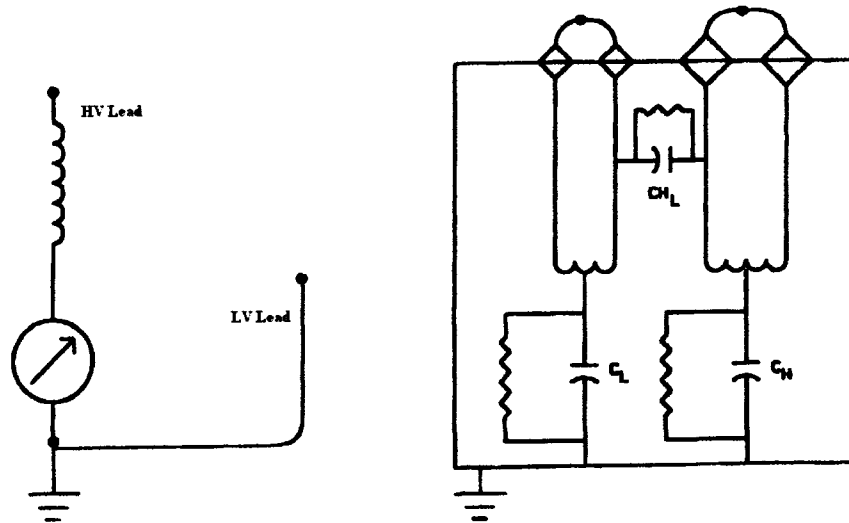
**JADUAL S3(a) / TABLE Q3(a)**

Test no	Test Mode	Winding energized	Winding grounded	Winding guarded	Insulation measured
1	Grounded	HV	LV	-	C <sub>H</sub> plus C <sub>HL</sub>
2	Guard	HV	-	LV	C <sub>H</sub>
3	Grounded	LV	HV	-	C <sub>L</sub> plus C <sub>HL</sub>
4	Guard	LV	-	HV	C <sub>L</sub>

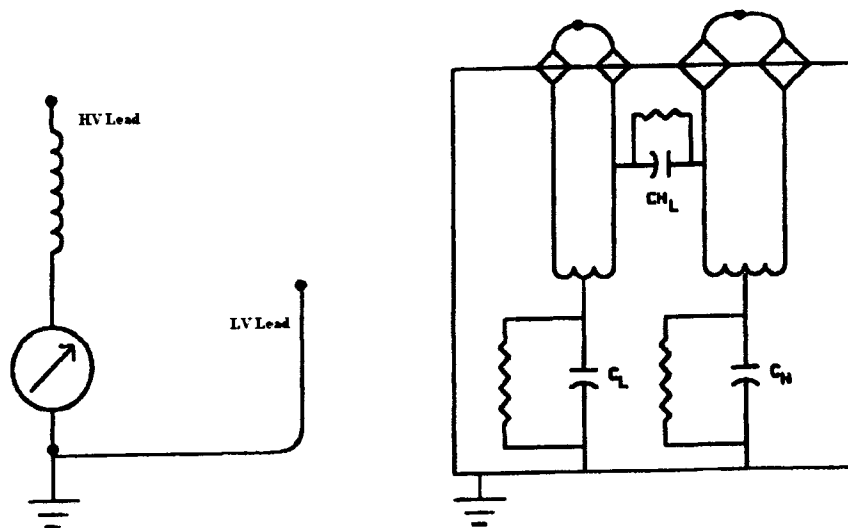
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**RAJAH S3(a)i / FIGURE Q3(a)i**

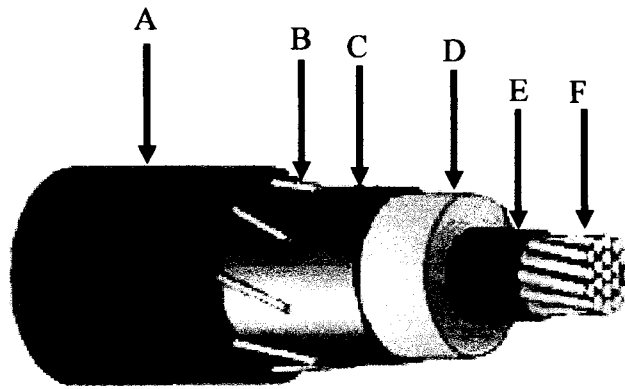


**RAJAH S3(a)ii / FIGURE Q3(a)ii**

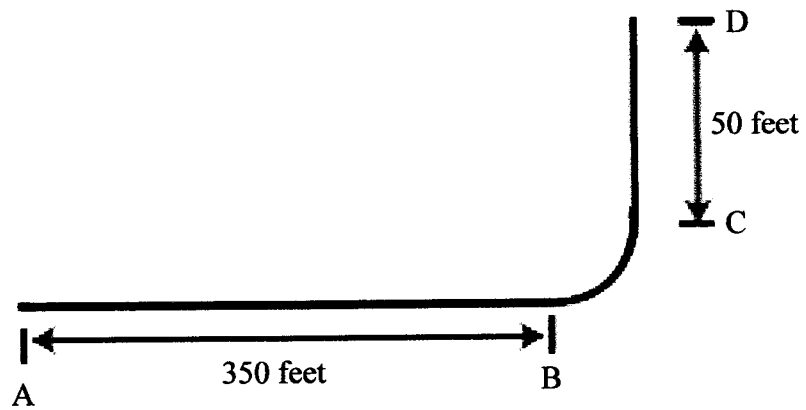
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**RAJAH S4(a) / FIGURE Q4(a)**



**RAJAH S4(c) / FIGURE Q4(c)**

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**JADUAL S4(c) / TABLE Q4(c) : Multiplying factor for angle of bend.**

<b>Coefficient of Friction</b>	<b>15°</b>	<b>30°</b>	<b>45°</b>	<b>60°</b>	<b>75°</b>	<b>90°</b>
0.30	1.08	1.17	1.27	1.37	1.48	1.60
0.40	1.11	1.23	1.37	1.52	1.69	1.87
0.50	1.14	1.30	1.48	1.69	1.92	2.19

**JADUAL S5(d) / TABLE Q5(d) : Circuit breaker standard temperature.**

<b>Equipment</b>	<b>Component</b>	<b>Rated Temp (C°)</b>		
		<b>(T<sub>ra</sub>)</b>	<b>Ambient Rise</b>	<b>Total (T<sub>r</sub>)</b>
<b>Low Voltage*</b>	<b>Terminal Connection**</b>			
<b>Circuit Breaker</b>	<b>to Buss (or cable)</b>	<b>40</b>	<b>55</b>	<b>95</b>