UNIVERSITI SAINS MALAYSIA

Second Semester Examination
Academic Session 2007/2008

April 2008

ZAE 388/4 – Non Destructive Testing
[Pengujian Tak Membinasakan]

Duration: 3 hours
[Masa : 3 jam]

Please ensure that this examination paper contains **SIX** printed pages before you begin the examination.
*[Sila pastikan bahawa kertas peperiksaan ini mengandungi **ENAM** muka surat yang bercetak sebelum anda memulakan peperiksaan ini.]*

Instruction: Answer **FIVE** questions : **THREE** from Section A and **TWO** Section B. Students are allowed to answer all questions in Bahasa Malaysia or in English.

*[**Arahan**: Jawab **LIMA** soalan : **TIGA** dari Bahagian A dan **DUA** dari Bahagian B. Pelajar dibenarkan menjawab semua soalan sama ada dalam Bahasa Malaysia atau Bahasa Inggeris.]*

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Section A. *[Bahagian A]*

1. (a) Describe one technique of non-destructive testing to
[Huraikan satu teknik pengujian takmembinasakan untuk]

(i) check sub-surface defect
[memeriksa kecacatan sub-permukaan]

(ii) measure the thickness of plating
[menyukat ketebalan saduran]

(60/100)

(b) State the basic principle for visual method and discuss **THREE** (3) factors that will affect the reliability of this technique.
*[Sebutkan prinsip asas kaedah pandangan serta bincangkan **TIGA** (3) faktor yang menjejaskan keboleharapan teknik ini.]*

(40/100)

2. (a) (i) What is meant by eddy current and describe how it is produced.
[Apakah yang dimaksudkan dengan arus pusar dan terangkan bagaimana ianya dihasilkan.]

(ii) Describe how "skin effect" is formed. Discuss **THREE** (3) factors that influence this skin effect.
*[Terangkan bagaimana "kesan kulit" terjadi. Perihalkan **TIGA** (3) faktor yang mempengaruhi kesan kulit ini.]*

(50/100)

(b) The fuel element in nuclear industry must be ensured that no fission core and its products (except ionizing radiation) comes out from the cladding and no liquid "moderator" enters into it. In addition the fuel element must be nicely fixed to the cladding. Describe in details, where relevant with the aid of diagrams,
[Unsur bahanapi di dalam industri nuklear mesti dipastikan tiada teras bahan boleh belah dan hasilannya (kecuali sinaran mengion) keluar daripada penyalut dan tiada cecair "moderator" memasuki ke dalamnya. Di samping itu ikatan bahanapi ke penyalut mestilah kemas. Huraikan dengan terperinci, dan di mana perlu dengan bantuan gambarajah,]

(i) Leak technique used in examining the accuracy of the cladding.
[Teknik bocor yang digunakan untuk menguji kejituan penyalut.]

(ii) Thermal technique to test that the fuel element is nicely fixed to the cladding.
[Teknik terma untuk menguji kesempurnaan ikatan teras bahan kepada penyalut.]

(50/100)

3. (a) Describe in detail, including the shape of hysterisis loop, **FIVE** (5) characteristics of the specimen under test and the ferromagnetic particles used to ensure effective detection in continuous magnetic particle testing process.
*[Huraikan secara terperinci, termasuk bentuk gegelung histerisis, **LIMA** (5) sifat yang perlu ada kepada spesimen yang diuji dan serbuk feromagnet yang digunakan bagi memastikan keberkesanan di dalam proses pengujian zarah magnet selanjar.]*

(35/100)

(b) (i) Describe the physics principle involved in the liquid penetration testing.
[Terangkan prinsip fizik yang terlibat di dalam pengujian penusukan cecair]

(ii) Describe **SEVEN** (7) basic steps taken in this liquid penetration testing.
*[Huraikan **TUJUH** (7) langkah asas yang dilaksanakan di dalam pengujian penusukan cecair ini.]*

(65/100)

4. (a) (i) Detail out, with the aid of diagrams, the following methods that are used in ultrasonic testing
[Huraikan dengan terperinci, beserta gambarajah, kaedah berikut yang dilaksanakan di dalam pengujian ultrasonik]

- pulse echo testing system
[sistem pengujian gema denyut]
- direct transmission testing system
[sistem pengujian penghantaran terus]

(ii) State **TWO** (2) roles of couplant in ultrasonic testing and list down **SIX** (6) characteristics that must be possessed by the couplant.
*[Nyatakan **DUA** (2) peranan pengganding ("couplant") di dalam pengujian ultrasonik dan senaraikan **ENAM** (6) sifat yang perlu ada padanya.]*

(70/100)

(b) Write short notes on the following electrical methods:
[Tuliskan nota ringkas berkaitan kaedah elektrik berikut:]

(i) resistance *[rintangan]*

(ii) triboelectric *[triboelektrik]*

(30/100)

Section B. *[Bahagian B]*

5. Study the following Figure 1 and answer the questions below:
[Kaji Rajah 1 dan jawap soalan-soalan di bawah:]

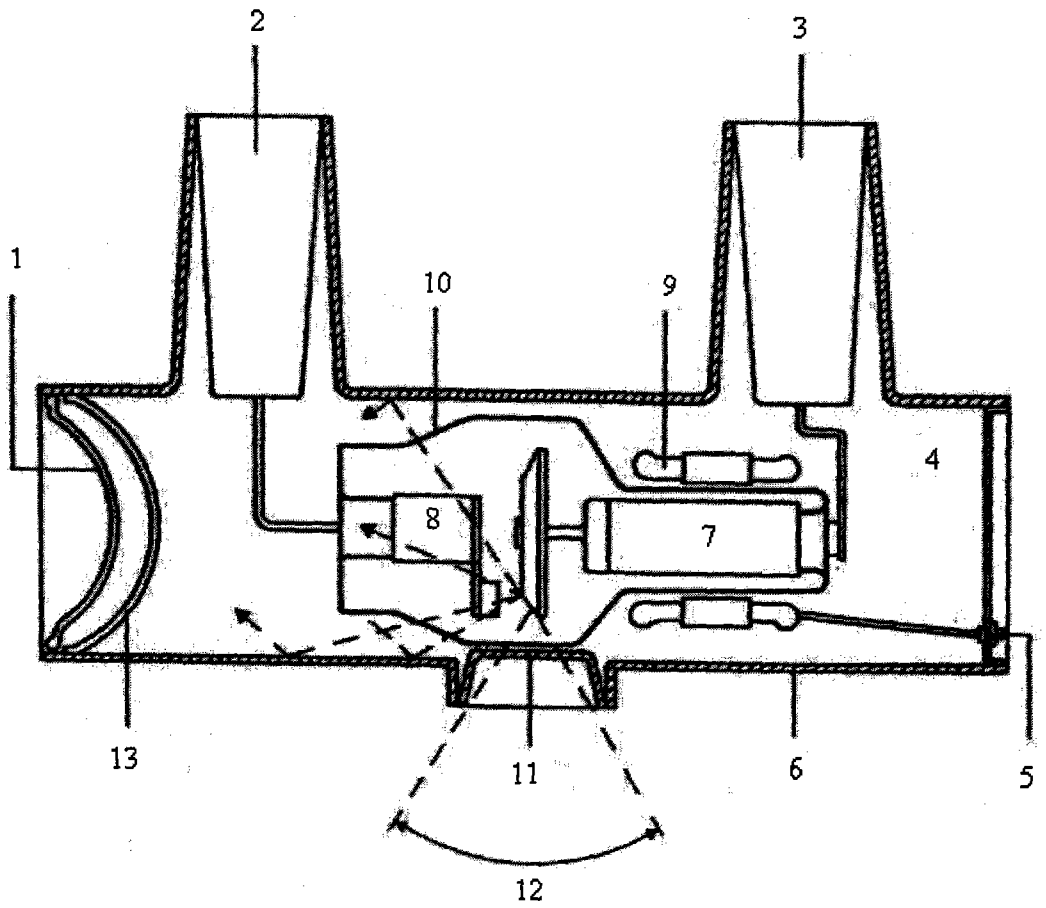

Figure 1 *[Rajah 1]*

(a) the following numbers in the figure refer to:
[nombor-nombor berikut merujuk kepada:]

1-	8-
2-	9-
3-	10-
4-	11-
5-	12-
6-	13-
7-	

(40/100)

(b) Explain with a diagram the basic circuit of an x-ray machine.
[Jelaskan menggunakan rajah litar asas mesin sinar-x.]

(40/100)

(c) Discuss the importance of the rectifier in the x-ray machine with figures.
[Bincangkan kepentingan suatu rektifier di dalam mesin sinar-x menggunakan rajah.]

(20/100)

6. (a) Discuss the advantages and disadvantages of the following radiography methods:
[Bincangkan kelebihan dan kekurangan kaedah-kaedah radiograf berikut:]

(i) X-ray radiography.
[Radiografi sinar-x.]

(ii) Gamma ray radiography.
[Radiografi sinar gama.]

(iii) Transmission electron radiography.
[Radiografi pancaran elektron.]

(iv) Neutron radiography.
[Radiografi neutron.]

(50/100)

(b) Explain with diagrams the use of Beta particles in thickness measurement. *[Jelaskan menggunakan rajah penggunaan zarah Beta di dalam pengukuran ketebalan.]*

(30 marks)

(c) Which is more efficient in thickness measurement? Discuss. *[Yang manakah satu lebih cekap untuk pengukuran ketebalan?. Bincangkan.]*

(i) Gamma ray. *[Sinar Gama]*

(ii) Beta ray. *[Sinar Beta]*

(20 marks)

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