UNIVERSITI SAINS MALAYSIA

First Semester Examination
Academic Session 2009/2010

November 2009

ESA 381/3 - Spacecraft Sub-system Elements
Elemen Sub-sistem Kapal Angkasa

Duration : 3 hours
[Masa : 3 jam]

ARAHAN KEPADA CALON :
INSTRUCTION TO CANDIDATES

Please ensure that this paper contains **SIX (6)** printed pages and **SIX (6)** questions before you begin examination.
*Sila pastikan bahawa kertas peperiksaan ini mengandungi **ENAM(6)** mukasurat bercetak dan **ENAM (6)** soalan sebelum anda memulakan peperiksaan ini.*

Answer **FIVE (5)** questions. All questions carry the same marks.
*Jawab **LIMA (5)** soalan. Semua soalan membawa jumlah markah yang sama*

Student may answer the question in English.
Pelajar boleh menjawab soalan dalam Bahasa Inggeris.

Each questions must begin from a new page.
Setiap soalan mestilah dimulakan pada mukasurat yang baru.

In the event of any discrepancies, the English version shall be used.
Sekiranya terdapat sebarang percanggahan pada kertas soalan, versi Bahasa Inggeris hendaklah digunakan pakai.

1. (a) What is the basic principle used in order to design gyroscope?

Apakah prinsip asas yang digunakan untuk mereka cipta giroskop?

(5 marks/*markah*)

(b) Explain your understanding about Variable Speed Control Moment Gyro system?

Terangkan mengikut kefahaman tentang sistem Pemboleh ubah Kelajuan Giro Kawalan Momen ?

(5 marks/ *markah*)

(c) Momentum and reaction wheels are devices used for of angular momentum storage in spacecraft. What are the difference between these devices and explain their application.

Momentum dan roda reaksi adalah peralatan yang digunakan untuk menyimpan momentum putaran di dalam kapal angkasa. Apakah perbezaan di antara dua alat ini dan terangkan kegunaan kedua-dua alat ini.

(10 marks/*markah)*

2. (a) What is the advantage of electric propulsion compared to chemical propulsion?

Apakah kelebihan pendorongan elektrik berbanding dengan pendorongan kimia?

(5 marks/*markah*)

(b) Define the Specific Impulse (Isp) and how the value of Isp can be utilized to choose the propulsion system according to the spacecraft mission?

Takrifkan maksud Impuls Tentu (Isp) dan bagaimana nilai Isp digunakan untuk menentukan pemilihan sistem dorongan berdasarkan misi kapal angkasa.

(10 marks/*markah*)

(c) What are the advantages and disadvantages of nuclear power propulsion system?

Apakah kelebihan dan kekurangan sistem dorongan kuasa nuklear?

(5 marks/*markah*)

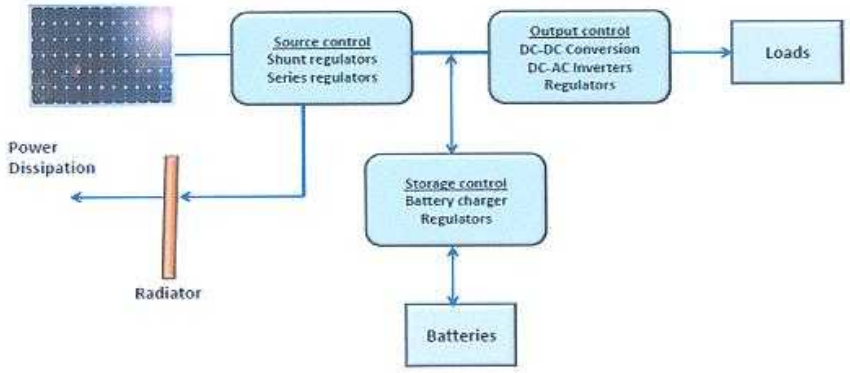

Figure 3.1: Power control function on a Direct Energy Transfer System

Rajah 3.1: Fungsi Kawalan Kuasa pada sistem Pemindahan Tenaga secara terus

3. (a) Refer to **Figure 3.1**, describe the function of the Source Control. Explain the difference between shunt regulators and series regulator.

*Merujuk kepada **Rajah 3.1**, terangkan fungsi Kawalan Punca. Jelaskan perbezaan di antara pengawal atur pirau dan pengawal atur siri.*

(15 marks/*markah*)

(b) What is the tradeoff between Attitude Determination and Control System (ADCS) and power system in spacecraft?

Apakah keseimbangan di antara Sistem Penentuan dan Kawalan Sikap dan Sistem Kuasa di dalam sebuah kapal angkasa?

(5 marks/*markah*)

4. (a) With the aid of diagram, explain briefly the communication links consisted in communication sub-system.

Dengan bantuan gambar rajah, terangkan secara ringkas hubungan rangkai komunikasi di dalam subsistem komunikasi.

(10 marks/*markah*)

(b) Describe the difference between two types of transponder by using diagrams.

Gambarkan perbezaan di antara 2 jenis transponder dengan menggunakan gambar rajah.

(10 marks/*markah*)

5. (a) Why most of the spacecraft using passive system in their thermal control subsystem?

Mengapa kebanyakan kapal angkasa menggunakan sistem pasif di dalam sistem kawalan haba?

(5 marks/*markah*)

(b) What is the function of radiator in thermal control system in spacecraft? Give other **TWO** examples of thermal control system elements in spacecraft and explain the function briefly.

*Apakah fungsi radiator di dalam sistem kawalan haba di dalam kapal angkasa? Berikan **DUA** contoh elemen di dalam sistem kawalan haba dan terangkan fungsinya secara ringkas.*

(15 marks/*markah*)

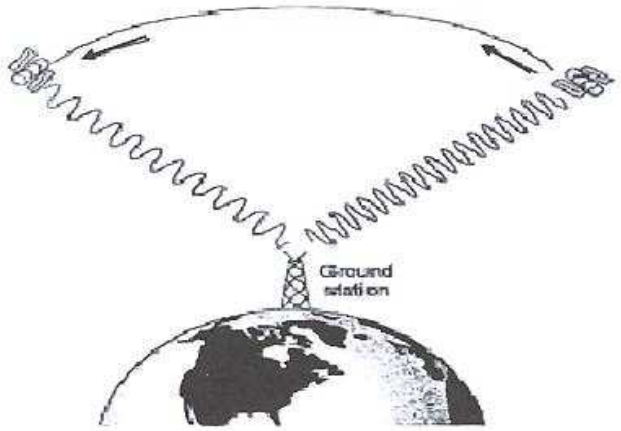

Figure 6.1: Principle of operation of Doppler effect based satellite navigation systems

Rajah 6.1: Prinsip operasi Sistem Pemanduan arah berdasarkan kesan Doppler

6. (a) Refer to **Figure 6.1**, describe the Doppler effect based satellite navigation system.

*Merujuk **Rajah 6.1**, terangkan sistem pemanduan arah satelit berdasarkan kesan Doppler.*

(5 marks/*markah*)

7. (b) By using diagram, explain **THREE** basic principles of Global Positioning System (GPS)

*Dengan menggunakan gambar rajah, terangkan **TIGA** prinsip asas Sistem Kedudukan Global.*

(15 marks/*markah*)

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