

UNIVERSITI SAINS MALAYSIA

**Peperiksaan Semester Pertama
Sidang Akademik 2002/2003**

September 2002

ESA 351 – Instrumentasi & Peralatan Pesawat

Masa : [3 Jam]

ARAHAN KEPADA CALON :

1. Sila pastikan bahawa kertas peperiksaan ini mengandungi **(8) LAPAN** mukasurat bercetak dan **(7) TUJUH** soalan.
2. Anda dikehendaki menjawab **(5) LIMA** soalan sahaja.
3. Agihan markah bagi setiap soalan diberikan di sut sebelah kanan.
4. Satu soalan **wajib** dijawab dalam Bahasa Melayu.
5. Mesin kira bukan yang boleh diprogram boleh digunakan.
6. Buku rumus disediakan.

1. (a) Apakah yang dimaksudkan dengan sistem perolehan data?
Jelaskan unsur dari penyesuaian isyarat.
What is data acquisition system?
Describe element of signal conditioning
(5 markah/marks)
- (b) Jelaskan kekuatan dan kelemahan dari:
- sistem peroleh data pengelogg data,
- sistem peroleh data palam PC,
- sistem peroleh data satah belakang komputer,
- sistem peroleh data berasas rangkaian.

Describe strengths and weaknesses of:
- *data logger data acquisition system,*
- *PC plug-in data acquisition system,*
- *computer back-plane data acquisition system,*
- *network-based data acquisition system.*
(10 markah/marks)
- (c) Apakah bezanya antara data dan maklumat?
Bezakan antara kabel isyarat multipleks dan kabel isyarat bukan-multipleks.
What is the different between data and information?
Differentiate between multiplexed and non-multiplexed signal cabling.
(5 markah/marks)

2. (a) (i) Jelaskan tentang kebezajelasan dari penukar analog-digit (ADC), ralat pengkuantuman dan digit bererti terkecil untuk satu pengukuran.
Describe about resolution of analogue to digital converter (ADC), quantization error and Least Significant Bit of one measurement.
- (ii) Apakah blok binaan elektronik biasa yang membina ADC?
What are common electronic building blocks which build ADC?
- (7 markah/marks)**
- (b) (i) Jelaskan bagaimana penukar digit-analog berfungsi.
Explain how D/A converters work.
- (6 markah/marks)**
- (c) Jelaskan kekuatan dan kelemahan dari:
- penukar analog-digit kamiran,
 - penukar analog-digit selari,
 - penukar analog-digit dua langkah.
- Describe strengths and weaknesses of:*
- *integrating A/D converters,*
 - *parallel A/D converters,*
 - *two-step A/D converters.*
- (7 markah/marks)**

3. Parameter untuk hubungan A/D diberi sebagai:
The parameters for A/D connection are given:

$$V_{in} = 5.2 \text{ volt}$$

$$V_{ref} = 64 \text{ volt}$$

Resolusi (n) = 6 digit.

Resolution (n) = 6 digit

Kira dan jelaskan formula berikut.

Calculate and explain for the following formula.

(i) A/D kamiran
Integrating A/D

(ii) A/D selari
Parallel A/D

(iii) A/D dua langkah (setiap satu langkah dengan 3 digit)
Two-step A/D (each step in 3 digit)

- (a) Jelaskan bagaimana penukar analog-digit kamiran berfungsi untuk parameter-parameter tersebut.
Explain how integrating A/D converters work for those parameters.

(7 markah/marks)

- (b) Jelaskan bagaimana penukar analog-digit selari berfungsi untuk parameter-parameter tersebut.
Explain how parallel A/D converters work for those parameters.

(6 markah/mark)

- (c) Jelaskan bagaimana penukar analog-digit dua langkah berfungsi untuk parameter-parameter tersebut.
Explain how two-step A/D converters are working for those parameters (each step is 3 digits).

(7 markah/marks)

4. (a) (i) Jelaskan perbezaan gelombang darat, udara dan angkasa. Berikan julat frekuensi dari tiap-tiap gelombang.
Describe the differences between ground, sky and space waves. Give the frequency range each of them.
- (ii) Apakah perbezaan antara frekuensi radio dan frekuensi suara?
What is the difference between radio frequency and audio frequency?
- (6 markah/marks)**
- (b) (i) Apakah kegunaan sebuah pengayun?
What is the purpose of oscillator?
- (ii) Jelaskan bagaimana sebuah pengayun menghasilkan arus ulang-alik.
Describe how an oscillator produces an alternating current.
- (7 markah/marks)**
- (c) (i) Jelaskan operasi penapis laluan tinggi dan penapis laluan rendah.
Describe the operation of a high-pass filter and a low-pass filter.
- (ii) Lakarkan litar sederhana penapis laluan tinggi dan penapis laluan rendah.
Draw a simple circuit of high-pass filter and a simple circuit of low-pass filter.
- (iii) Jelaskan prinsip pengesanan mudah.
Describe the principle of a simple detection.

(7 markah/marks)

5. (a) (i) Jelaskan prinsip radar.
Describe the principles of radars.
- (ii) Apakah perbezaan di antara mata dan radar?
What is the difference between the eye and radar?

(5 markah/marks)

- (b) (i) Apakah kesan Doppler?
What is the Doppler effect?
- (ii) Jelaskan prinsip meter laju radar.
Describe the principle of a radar speedometer.

(5 markah/marks)

- (c) Cari julat radar maksimum (R_{max}), apabila:
kuasa pemancar radar = 500 W,
frekuensi = 0.5 GHz,
gandaan antena = 10^4 ,
keratan lintang radar = 4 m^2 ,
isyarat boleh kesan minimum = 10^{-8} W .
Cari ketumpatan kuasa dari antena berarah pada julat radar maksimum.
Cari ketumpatan kuasa dari isyarat gema pada radar ketika target pada julat radar maksimum.

Find the maximum radar range (R_{max}), when:

power of the radar transmitter = 500 W,

frequency = 0.5GHz,

antenna gain = 10^4

radar cross section = 4 m^2 ,

minimum detectable signal = 10^{-8} W .

Find the power density from directive antenna at the maximum radar range.

Find the power density of echo signal at radar when the target is at the maximum radar range.

(10 markah/marks)

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6. (a) (i) Jelaskan operasi sistem pencari arah otomatis (ADF).
Describe the operation of an automatic direction finder (ADF) system.
- (ii) Jelaskan operasi sistem semua julat VHF (VOR).
Describe the operation of VHF omnirange (VOR) system.

(7 markah/marks)

- (b) (i) Apakah rujukan pandu arah yang dihasilkan oleh sistem alatan pendaratan (ILS)?
What navigational reference is generated by an instrument landing system (ILS)?
- (ii) Jelaskan secara ringkas operasi setempat.
Briefly describe the operation of a localizer.
- (iii) Bandingkan fungsi cerun luncur ILS dengan fungsi setempat.
Compare the glide slope function of an ILS with the function of a localizer.

(7 markah/marks)

- (c) (i) Jelaskan prinsip kelengkapan pengukur jarak (DME).
Explain the principle of distance-measuring equipment (DME).
- (ii) Apakah yang dimaksudkan dengan sebutan TACAN?
What is the meaning of the term TACAN?

(6 markah/marks)

7. (a) Bandingkan sistem pendaratan gelombang mikro (MLS) dengan sistem alatan pendaratan (ILS) dan nyatakan kelebihan MLS?
Compare the microwave landing system (MLS) with the instrument landing system (ILS) and state the advantages of MLS?

(6 markah/marks)

- (b) (i) Jelaskan prinsip sistem pandu arah inersia (INS).
Explain the principle of an inertial navigation system (INS).
- (ii) Apakah tiga hukum fizik asas yang membolehkan INS beroperasi?
What are the three basic laws of physics that make an INS operation possible?

(7 markah/marks)

- (c) (i) Jelaskan teori operasi sistem kedudukan sejagat (GPS).
Describe the theory of operation of a global positioning system (GPS).
- (ii) Jelaskan prinsip sistem pandu arah Doppler.
Explain the principle of a Doppler navigation system.
- (iii) Apakah fungsi yang dibuat oleh meter tinggi radar?
What function does a radar altimeter perform?

(7 markah/marks)