KOLEJ YAYASAN PELAJARAN JOHOR
ONLINE FINAL EXAMINATION

COURSE NAME	**:**	**INSTRUMENTATION**
COURSE CODE	**:**	**DKE 1033**
SESSION	**:**	**DECEMBER 2021**
DURATION	**:**	**2 HOURS 30 MINUTES**

INSTRUCTION TO CANDIDATES /
ARAHAN KEPADA CALON

1. This examination paper consists of **ONE (1)** part. PART A (100 Markah)
   *Kertas soalan ini mengandungi **SATU (1)** bahagian: BAHAGIAN A (100 Markah)*

2. Answer ALL questions in the answer sheet which is A4 size paper (or other paper with the consent of the relevant lecturer). /
   Jawab SEMUA soalan di dalam kertas jawapan iaitu kertas bersaiz A4 (atau lain-lain kertas dengan persetujuan pensyarah berkaitan).

3. Write your details as follows in the upper left corner for each answer sheet: /
   Tulis butiran anda sepertimana berikut di penjuru atas kiri bagi setiap kertas jawapan:
   i. Student Full Name / *Nama Penuh Pelajar*
   ii. Identification Card (I/C) No. / *No. Kad Pengenalan*
   iii. Class Section / *Seksyen Kelas*
   iv. Course Code / *Kod Kursus*
   v. Course Name / *Nama Kursus*
   vi. Lecturer Name / *Nama Pensyarah*

4. Each answer sheet must have a page number written at the bottom right corner. /
   Setiap helai kertas jawapan mesti ditulis nombor muka surat di penjuru bawah kanan.

5. Answers should be **neat and clear in handwritten form**. /
   Jawapan hendaklah ditulis tangan, kemas dan jelas.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO /
JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIBERITAHU

This examination paper consists of **6** printed pages including front page
Kertas soalan ini mengandungi 6 muka surat termasuk kulit hadapan

This part contains of **FIVE (5)** questions. Answer **ALL** questions in the answer sheet.
*Kertas soalan ini mengandungi **LIMA (5)** soalan. Jawab **SEMUA** soalan di dalam kertas jawapan.*

QUESTION 1 / ***SOALAN 1***

a) Analog devices are divided into **two (2)** methods of deflection. Explain the differences between the two methods.

*Alatan analog terbahagi kepada **dua (2)** kaedah pesongan. Terangkan perbezaan di antara kedua-dua kaedah tersebut.*

(4 marks/ ***markah*****)**

b) Describe **two (2)** types of errors that exist in a measurement.

*Huraikan **dua (2)** jenis ralat yang wujud dalam sesuatu pengukuran.*

(4 marks/ ***markah*****)**

c) Refer to **Figure Q1 (c)**. Calculate the power dissipated and the limiting error, if current 2.0 ± 0.01A flows through a 100 ± 0.2Ω resistor.

*Merujuk pada **Rajah Q1 (c)**. Kirakan kuasa terlesap dan ralat mengehad, jika arus bernilai 2.0 ± 0.01A mengalir melalui perintang 100 ± 0.2Ω.*

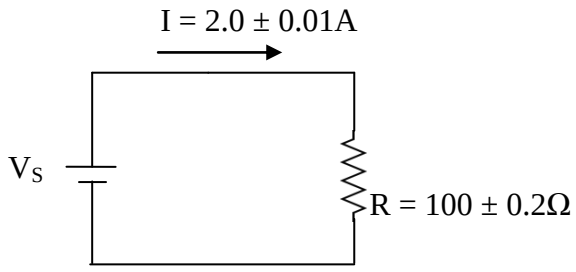

Figure Q1 (c) / ***Rajah Q1 (c)***

(12 marks/ ***markah*****)**

QUESTION 2 / *SOALAN 2*

a) Explain **two (2)** problems that can be solved if Ayrton shunt is used in multi-range ampere meter.

*Terangkan **dua (2)** masalah yang boleh diatasi sekiranya pirau Ayrton digunakan di dalam meter ampere berbilang julat.*

(4 marks/ *markah*)

b) A 100 µA full scale deflection current meter movement is used in an Ayrton multi-range ampere meter circuit. The meter movement has an internal resistance, R_m = 2 kΩ. Determine the value of the shunt resistance, if the meter has a range of 25 mA, 65 mA and 100mA.

Gerakan meter arus pesongan skala penuh 100 µA digunakan dalam litar meter ampere berbilang julat pirau Ayrton. Gerakan meter tersebut mempunyai rintangan dalam, R_m = 2 kΩ. Tentukan nilai rintangan pirau, jika meter tersebut mempunyai julat 25 mA, 65 mA dan 100mA.

(8 marks/ *markah*)

c) **Figure Q2 (c)** shows a full-wave rectifier type AC meter with a range of 1 V. The diodes have a forward resistance each of 100 Ω while the parameters of the d'Arsonval movement are 50 µA, 200 Ω. It is required that $I_{sh} = I_m$.

i. Calculate the shunt resistor, R_{sh}.
ii. Calculate the multiplier resistor, R_s.
iii. Calculate the AC sensitivity of the meter, S_{ac}.

***Rajah Q2 (c)** menunjukkan meter AU jenis penerus penuh-gelombang berjulat 1 V. Setiap diod mempunyai rintangan ke depan 100 Ω sementara parameter gerakan d'Arsonval ialah 50 µA, 200 Ω. Dikehendaki supaya $I_{sh} = I_m$.*

i. Kirakan rintangan pirau, R_{sh}.
ii. Kirakan rintangan pendarab, R_s.
iii. Kirakan kepekaan AU meter, S_{au}.

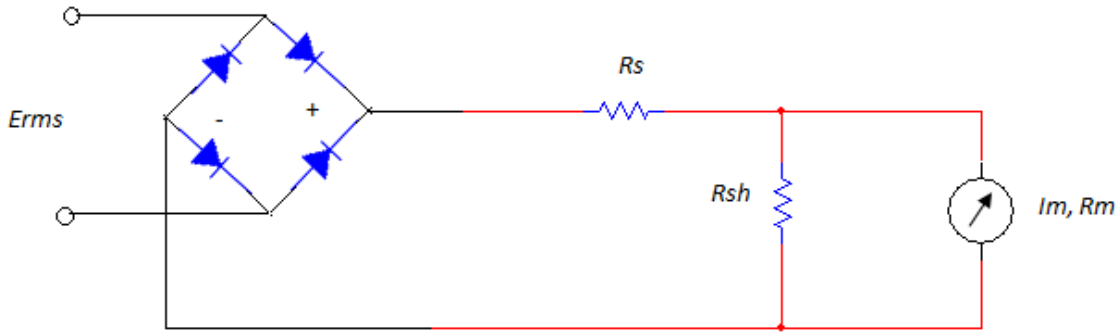

Figure Q2 (c) / ***Rajah Q2 (c)***

(8 marks/ ***markah*****)**

QUESTION 3 / ***SOALAN 3***

a) Briefly explain **four (4)** advantages of a digital voltmeter as compared to an analogue voltmeter.

Terangkan dengan ringkas ***empat (4)*** *kelebihan meter volt digital berbanding dengan meter volt analog.*

(12 marks/ ***markah*****)**

b) An analogue-to-digital converter uses an integrator in its input part.
   i. Sketch an integrator circuit with a resistor 10 kΩ and a capacitor 10 μF.
   ii. If the integrator input voltage is 1 V, calculate the integrator output voltage after 0.1 second.
   iii. Sketch the form of the integrator output voltage.

Penukar analog-ke-digit menggunakan pengamir pada bahagian masukan litar.
   i. Lakarkan litar pengamir dengan nilai perintang 10 kΩ dan pemuat 10 μF.
   ii. Jika voltan masukan pengamir ialah 1 V, kirakan voltan keluaran pengamir tersebut selepas 0.1 saat.
   iii. Lakarkan bentuk voltan keluaran pengamir.

(8 marks/ ***markah*****)**

QUESTION 4 / *SOALAN 4*

a) With the aid of diagrams, explain **two (2)** transducer functions.

*Dengan bantuan gambar rajah, terangkan **dua (2)** fungsi transduser.*

(6 marks/ *markah*)

b) **Figure Q4 (b)**, shows the LVDT and its specification.

i. Explain briefly the operation of the LVDT.

ii. Calculate the displacement if the output voltage is 2.5 mV.

iii. Sketch the graph of the output voltage versus displacement if the output of the LVDT is at the range of -4 mV to +2.5 mV.

***Rajah Q4 (b)**, menunjukkan LVDT dan spesifikasinya.*

i. Terangkan dengan ringkas prinsip pengendalian LVDT.

ii. Kirakan anjakan jika voltan keluaran ialah 2.5 mV.

iii. Lakarkan graf voltan keluaran melawan anjakan jika keluaran LVDT pada julat -4 mV hingga +2.5 mV.

The specification of LVDT is as follow: ***Spesifikasi LVDT ialah seperti berikut :***	
Input voltage / *Voltan masukan*	: 10 V
Output voltage / *Voltan keluaran*	: ±5 mV
Displacement range / *Julat anjakan*	: ±5 inch

Figure Q4 (b) / *Rajah Q4 (b)*

(14 marks/ *markah*)

QUESTION 5 / *SOALAN 5*

a) State the main application of a filter in an instrumentation system.

Nyatakan kegunaan utama penapis dalam sistem instrumentasi.

(3 marks/ markah)

b) The instrumentation system used to measure 100 Hz signals experiences noise at a frequency of 1 kHz.
   i. Design passive filter with a cut off frequency of 300 Hz.
   ii. Calculate the ratio of noise remaining in the system.
   iii. Calculate the error on the measurement signal.

Sistem pengalatan yang digunakan untuk mengukur isyarat 100 Hz mengalami hingar pada frekuensi 1 kHz.
   i. Reka bentuk penapis pasif dengan frekuensi potong 300 Hz.
   ii. Kirakan nisbah hingar yang masih terdapat dalam sistem tersebut.
   iii. Kirakan ralat pada isyarat ukuran.

(14 marks/ *markah*)

c) List down **three (3)** features of RS232.

*Senaraikan **tiga (3)** ciri-ciri RS232.*

(3 marks/ *markah*)

[100 MARKS / 100 MARKAH]

END OF QUESTION PAPER / *KERTAS SOALAN TAMAT*