POLITEKNIK MALAYSIA

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENGAJIAN POLITEKNIK
KEMENTERIAN PENDIDIKAN MALAYSIA

JABATAN KEJURUTERAAN ELEKTRIK

PEPERIKSAAN AKHIR

SESI DISEMBER 2013

EE101: MEASUREMENT

TARIKH : 08 APRIL 2014
TEMPOH : 11.15 AM- 1.15 PM (2 JAM)

Kertas ini mengandungi **DUA PULUH (20)** halaman bercetak.
Bahagian A: Objektif (20 soalan)
Bahagian B: Struktur (10soalan)
Bahagian C: Esei (2 soalan)
Dokumen sokongan yang disertakan : Tiada

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SECTION A : 20 MARKS

BAHAGIAN A : 20 MARKAH

INSTRUCTION:

This section consists of TWENTY (20) objective questions. Mark your answers in the OMR form provided.

ARAHAN:

Bahagian ini mengandungi DUA PULUH (20) soalan objektif. Tandakan jawapan anda di dalam borang OMR yang disediakan.

CLO1
C1

1. Select the best definition for measurement?
Pilih definisi terbaik untuk pengukuran?

A. Step to measure the electrical circuit
Langkah untuk mengukur litar elektrik

B. Process to clarify the equipment error
Proses untuk menjelaskan ralat peralatan

C. Process to measure the DCV and ACV using multimeter
Proses untuk mengukur DCV dan ACV menggunakan multimeter

D. Process of determine the amount, degree or capacity by comparison with the accepted standards of the system units being used
Proses menentukan jumlah, darjah atau kapasiti oleh perbandingan dengan piawaian yang diterima daripada unit sistem yang digunakan

CLO1
C2

2. "This element converts the output of the primary sensing element into suitable form to preserve the information content of the original signal." This statement describes about which element?

"Elemen ini menukarkan keluaran daripada elemen penderiaan utama ke dalam bentuk yang sesuai untuk memelihara kandungan maklumat isyarat asal. "Kenyataan ini menerangkan tentang elemen?

A. Primary sensing element
Elemen penderiaan utama

B. Data presentation element
Elemen persembahan data

C. Data Transmission Element
Elemen penghantaran data

D. Variable manipulation element
Elemen manipulasi pembolehubah

CLO1
C1

3. The ability of an instrument to respond t the weakest signal is defined as

Keupayaan alat untuk bertindak balas terhadap isyarat yang paling lemah ditakrifkan sebagai

A. Sensitivity
Kepekaan

B. Repeatability
Kebolehulangan

C. Resolution
Resolusi

D. Precision
Kejituan

CLO2 C3

4. The measured value of resistance is 450. 9Ω and the true value is 500Ω. Calculate the absolute error.

Nilai perintang yang diukur adalah 450.9Ω dan nilai sebenar adalah 500Ω. Kirakan nilai ralat mutlak.

A. 9.82%

B. 98.2%

C. 49.1Ω

D. 4.91Ω

CLO2 C3

5. A Permanent Magnet Moving Coil (PMCC) instrument with a 200 turns coil has a magnetic flux density in air gap of B = 0.3 wb/m2. The coil dimension, D = 1 cm and the length of the coil, l = 1.5 cm. Calculate the torque on the coil for a 1 mA.

Instrumen Gegelung Bergerak Magnet Kekal (PMCC) dengan gegelung 200 lilitan mempunyai ketumpatan fluks magnet dalam ruang udara B = 0.3 wb/m2. Dimensi gegelung, D = 1 cm dan panjang gegelung, l = 1.5 cm. Kira daya pada gegelung untuk 1 mA.

A. 9×10^{-6} Nm

B. 9×10^{-4} Nm

C. 0.9 Nm

D. 9×10^{-10} Nm

CLO2 C3

6. A basic Permanent Magnet Moving Coil (PMMC) meter moves with the full scale deflection current of 20μA and has an internal resistance of 200 Ω that is used as a voltmeter. Calculate the value of the multiplier, Rs that is needed to measure the voltage range of 0 – 10 V.

Satu meter Gegelung Bergerak Magnet Kekal (GBMK) bergerak dengan pesongan skala penuh arus 20μA dan mempunyai rintangan dalaman sebanyak 200 Ω digunakan sebagai voltmeter. Kirakan nilai pengganda rintangan, Rs yang diperlukan untuk mengukur julat voltan 0 - 10 V.

A. 499.8 Ω

B. 4.998 MΩ

C. 499.8 kΩ

D. 0.499Ω

CLO1
C1

7. Name of the damping curve stated as A in Figure A7 is

Nama bagi lengkok redaman A seperti Rajah A7 ialah

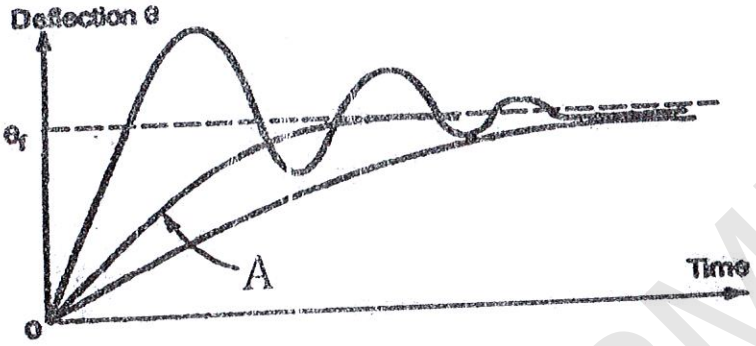


Figure A7/*Rajah A7*

A. Over damping

B. Critical damping

C. Under damping

D. Deflection damping

CLO1
C1

8. To measure the current flow through a circuit, an ammeter should be placed in _____ in the circuit.

Untuk mengukur arus yang mengalir di dalam litar, meter arus perlu di letakkan secara ..... di dalam litar.

A. Vertical
Menegak

B. Horizontal
Mendatar

C. Series
Sesiri

D. Parallel
Selari

CLO1
C3

9. Figure A9 shows a block diagram of analogue oscilloscope. Choose the **BEST** answer that describe the suitable system in the block diagram.

*Rajah A9 menunjukkan rajah blok bagi osiloskop analog. Pilih jawapan **TERBAIK** yang menerangkan sistem sebenar bagi rajah blok.*

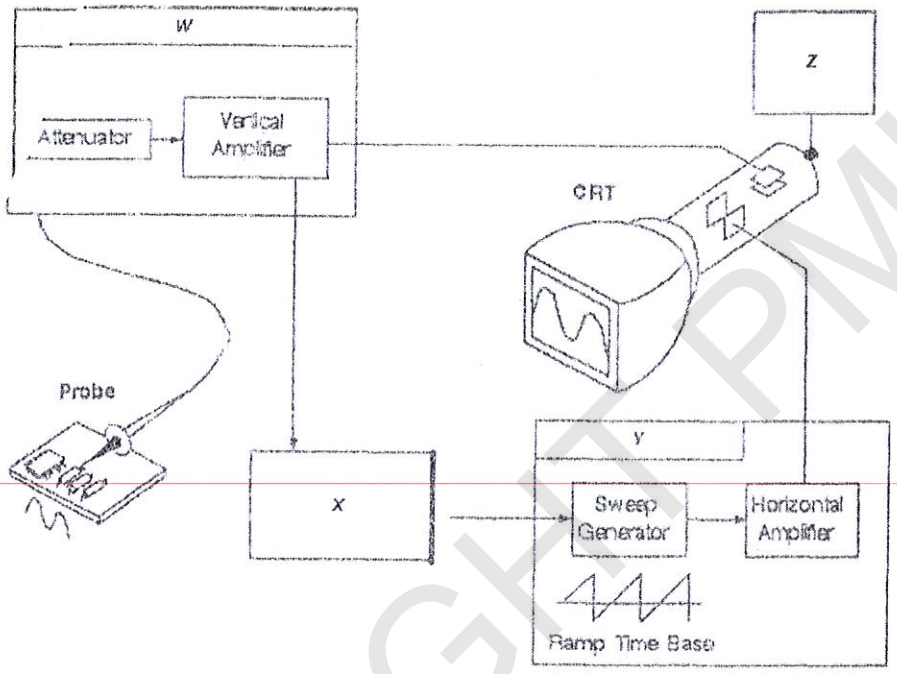


Figure A9/*Rajah A9*

	W	*X*	*Y*	*Z*
A.	Vertical system	Display System	Horizontal System	Trigger System
B.	Horizontal System	Display System	Vertical system	Trigger System
C.	Vertical system	Trigger System	Horizontal System	Display System
D.	Horizontal System	Trigger System	Vertical system	Display System

CLO2
C3

10. Figure A10 shows an output waveform that appears on oscilloscope display. The readings given for frequency is 5kHz. The expected time/div is:

Rajah A10 menunjukkan gelombang keluaran pada paparan osiloskop. Bacaan bagi frekuensi ialah 5kHz. Time/div yang disetkan ialah:

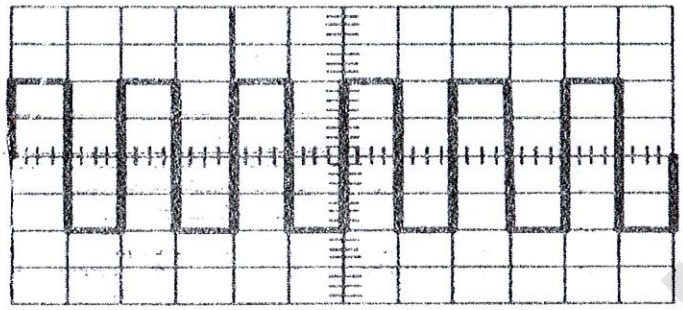


Figure A10/*Rajah A10*

A. 1ms

B. 0.1ms

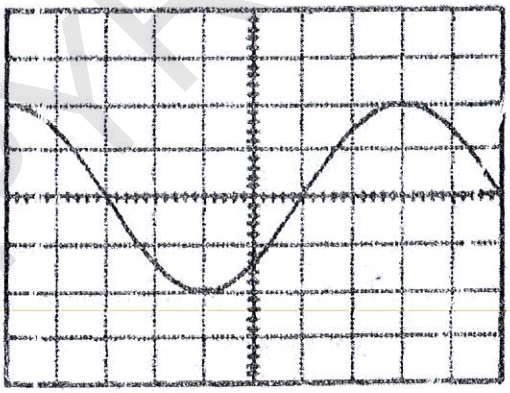
C. 0 .01ms

D. 0.2ms

CLO2
C3

11. Referring to Figure A11.The value peak-to peak voltage is

Merujuk Rajah A11.Nilai voltan puncak ke puncak adalah.



Volt / div: 2V / div, Probe: X1, Time / div: 1ms / Div

Figure A11/*Rajah A11*

A. 0.80 Vp-p

B. 8.0 Vp

C. 8.0 Vp-p

D. 0.80 Vp

CLO1
C1

12. Below are **THREE (3)** types of waveform signal that can be obtained from signal generator **EXCEPT**.

*Berikut adalah **TIGA (3)** jenis isyarat gelombang yang boleh diperolehi daripada penjana isyarat **KECUALI**.*

A. Sine / *Sin*

B. Square / *Segiempat*

C. Triangle / *Segitiga*

D. Saw tooth / *Saw tooth*

CLO1
C3

13. The Wheatstone bridge circuit shown in Figure A13 is balanced. What is the relationship between the resistances.

Litar tetimbang Wheatstone di dalam Rajah A13 adalah seimbang. Apakah hubungan antara rintangan – rintangan itu.

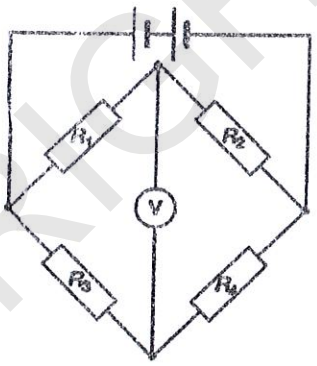


Figure A13/*Rajah A13*

A. $R_1 + R_2 = R_3 + R_4$

B. $R_1 = \frac{R_4}{R_2 R_3}$

C. $R_1 X\, R_4 = R_2 X\, R_3$

D. $R_1 - R_2 = R_3 - R_4$

CLO2
C1

14. The function of Kelvin bridge is to:
Kegunaan tetimbang Kelvin adalah untuk:

A. Balance the circuit
Seimbangkan litar

B. Measure zero current
Mengukur arus sifar

C. Measure the value of resistance
Mengukur nilai perintang

D. Adjust the bridge
Melaraskan tetimbang

CLO2
C3

15. Calculate the value of Rx in a Wheatstone bridge when R1 = 400Ω, R2 = 5KΩ, R3 = 2KΩ.
Kirakan nilai Rx dalam tetimbang Wheatstone apabila R1 = 400Ω, R2 = 5KΩ, R3 = 2KΩ.

A. 160 Ω
B. 25 kΩ
C. 1 kΩ
D. 250 kΩ

CLO2
C2

16. A _____ is a type of meter which measures electrical current (AC) without need to disconnect the wiring through which the current is flowing.
_____ *adalah sejenis meter yang boleh mengukur arus elektrik AC tanpa perlu memutuskan sambungan pendawaian.*

A. Clamp meter
Meter Pengapit
B. Kilowatt Hour Meter
Meter Kilowatt Jam
C. Multimeter
Meter Pelbagai
D. Ammeter
Meter Ampere

CLO1
C1

17. Referring to Figure A17, identify the part that label with X.

Merujuk kepada Rajah A17, kenalpasti bahagian yang berlabel dengan X.

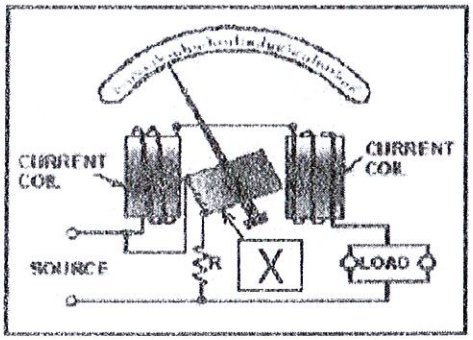


Figure A17/*Rajah A17*: Electrodynamics Wattmeter Circuit

A. Potential Coil

Gegelung Voltan

B. Filter Coil

Gegelung Penapis

C. Compensating Coil

Gegelung Pemampasan

D. Bias Coil

Gegelung pincang

10

CLO1
C1

18. Referring to device in Figure A18, state the name of the device.

Merujuk kepada peralatan dalam Rajah A18, nyatakan nama peralatan ini.

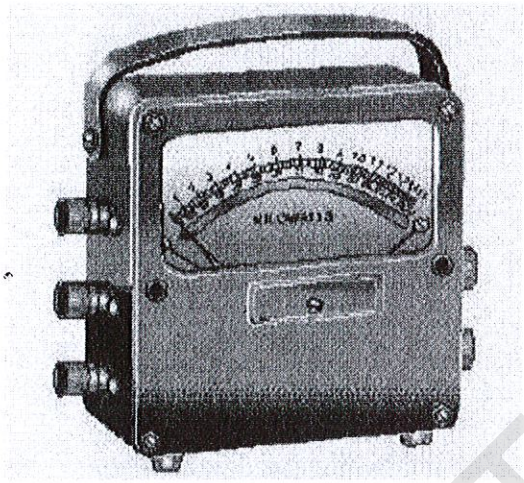


Figure A18/*Rajah A18*

A. Analogue wattmeter
Meter watt analog

B. Digital wattmeter
Meter watt digital

C. Analogue KWH meter
Meter KWH analog

D. Digital KWH meter
Meter KWH digital

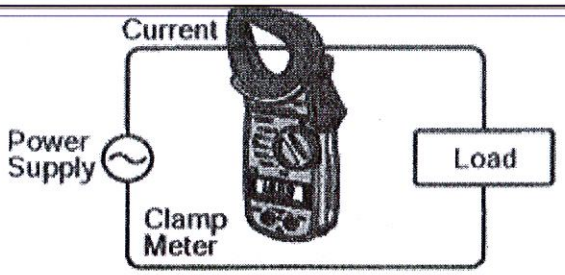


Figure A19/*Rajah A19*

CLO2 C2

19. All the statements below are CORRECT for the procedure of using clamp meter for measuring the frequency of a voltage EXCEPT

Semua penyataan berikut adalah BENAR bagi prosedur penggunaan meter clamp untuk mengukur frekuensi voltan KECUALI

A. Set the rotary selector switch to a voltage position. Then, press the Hz button.
Setkan suis pemilih kepada posisi voltan. Kemudian tekan punat Hz.

B. Connect the black test lead to the COM terminal and the red test lead to the V/Ω terminal.
Sambungkan prob penguji hitam ke terminal COM dan prob penguji merah ke terminal V/Ω.

C. By using the clamp, fully enclose the conductor under test in the jaws.
Dengan menggunakan clamp, tutup rapat konduktor yang di uji di dalam jaw.

D. Connect the other ends of the test leads to the circuit, component, or other device under test.
Sambungkan prob penguji yang lain ke litar, komponen atau alat yang di uji.

CLO2 C2

20. The analog wattmeter consists of a pair of fixed coil. One of the coils is call as……
Meter watt analog terdiri daripada sepasang gegelung tetap. Satu daripada gegelung itu dinamakan……

A. Fixed coil
Gegelung tetap

B. Power coil
Gegelung kuasa

C. Potential coil
Gegelung upaya

D. Magnetic coil
Gegelung magnetik

SECTION B : 30 MARKS
BAHAGIAN B : 30 MARKAH

INSTRUCTION:
This section consists of **TEN (10)** structured questions. Answer **ALL** questions.

ARAHAN:
*Bahagian ini mengandungi **SEPULUH (10)** soalan berstruktur. Jawab **SEMUA** soalan.*

CLO1
C2

QUESTION 1
Give **TWO (2)** methods to reduce errors in measurement.

SOALAN 1
*Berikan **DUA (2)** cara mengurangkan ralat dalam* pengukuran

[3 marks]
[*3 markah*]

CLO1
C1

QUESTION 2
State the difference between accuracy and precision and explain why this difference is significant.

SOALAN 2
Nyatakan perbezaan antara ketepatan dan kepersisan dan terangkan kenapa perbezaan ini penting.

[3 marks]
[*3 markah*]

CLO1
C2

QUESTION 3

Based on suitable block diagrams, illustrate the measurement process.

SOALAN 3
Berpandukan gambarajah blok yang sesuai, gambarkan proses pengukuran.

[3 marks]
[*3 markah*]

CLO1
C3

QUESTION 4

A 1mA meter movement with an internal resistant of 50Ω is to be used. The battery voltage is 3V. Half scale deflection is 0.5Ω. Calculate the values of R1 and Rsh.

SOALAN 4

Sebuah ammeter dengan pergerakan 1mA dengan rintangan dalaman 50Ω akan digunakan. Voltan bateri adalah 3V. Separuh pesongan perlu 0.5Ω. Kirakan nilai R1 dan Rsh.

[3 marks]
[*3 markah*]

CLO2
C2

QUESTION 5

Meter is an instrument to measure electrical quantity.

i. Define sensitivity of meter
ii. State THREE (3) safety precaution to prevent accident when using meter

SOALAN 5

Meter adalah alat yang digunakan untuk mengukur nilai electrik

i Berikan definasi kepekaan meter
ii. Nyatakan TIGA (3) langkah-langkah keselamatan untuk mengelakkan kemalanagan masa menggunakan meter

[3 marks]
[*3 markah*]

CLO1
C1

QUESTION 6

List TWO (2) applications of DC Bridge.

SOALAN 6

Senaraikan DUA(2) kegunaan Tetimbang AT.

[3 marks]
[*3 markah*]

CLO2
C3

QUESTION 7

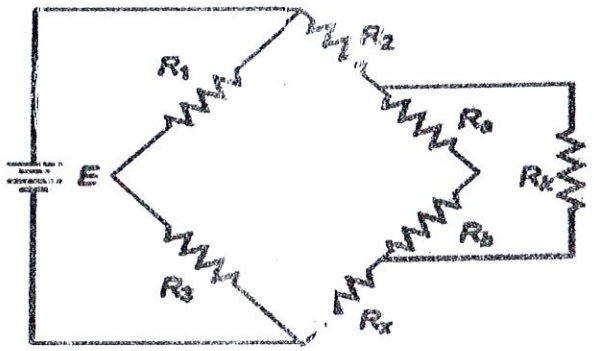


Figure 1 7/*Rajah B 7*

If in Figure B7, the ratio of Ra to Rb is 1000Ω, R_1 is 5Ω and $R_1 = 0.5R_2$.Calculate the value of Rx.

SOALAN 7

Jika dalam Rajah A7, nisbah Ra untuk Rbdalah 1000Ω, R_1 adalah 5Ω dan $R_1 = 0.5R_2$. Kirakan nilai Rx.

[3 marks]
[*3 markah*]

CLO 1
C1

QUESTION 8
Draw the Wheatstone bridge circuit.

SOALAN 8
Lukiskan litar tetimbang Wheatstone.

[3 marks]
[*3 markah*]

CLO 1
C3

QUESTION 9

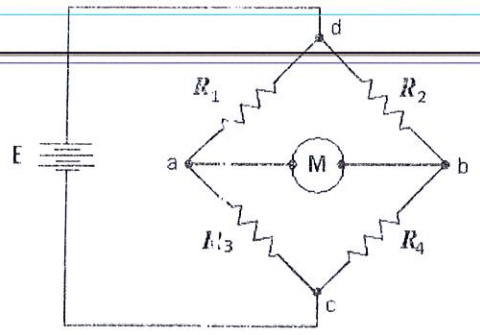


Figure B 9/*Rajah B 9*

Referring to Figure B9, given R1 = 1.5KΩ, R2 = 1KΩ, R3 = 3KΩ and R4= 2KΩ. Prove that the bridge is a balanced condition.

SOALAN 9

Merujuk Rajah B9, diberi R1 = 1.5KΩ, R2 = 1KΩ, R3 = 3KΩ and R4= 2KΩ. Buktikan bahawa tetimbang berada dalam keadaan seimbang.

[3 marks]
[*3 markah*]

CLO2
C2

QUESTION 10

Draw the symbol of watt meter.

SOALAN 10

Lukiskan simbol bagi Meter Watt.

[3 marks]
[*3 markah*]

SECTION C : 50 MARKS
BAHAGIAN C : 50 MARKAH

INSTRUCTION:
This section consists of **TWO (2)** essay questions. Answer **ALL** question.

ARAHAN:
*Bahagian ini mengandungi **DUA (2)** soalan esei. Jawab **SEMUA** soalan.*

QUESTION 1
SOALAN 1

CLO2
C3

(a) The expected value of the voltage across a resistor is 79V. However, the measurement gives a value of 80V. Calculate:

i. Absolute error
ii. Relative Accuracy
iii. Percentage of Accuracy

Nilai jangkaan bagi voltan yang melalui sebuah perintang ialah 65V. Walaubagaimanapun, dalam pengukuran nilai yang di perolehi ialah 61V. kirakan:

i. Ralat mutlak
ii. Ketepatan relatif.
iii. Peratus ketepatan

[5 marks]
[*5 markah*]

(b) Based on the Figure C 1 (b), identify the following, value if the oscilloscope setting Volt/Div = 0.5 V/Div, Time/ Div = 0.5µs/Div

Berdasarkan Rajah C 1(b), kirakan nilai jika Osiloskop disetkan Volt/Div = 100mV/Div, Time/ Div = 0.5ms/Div

i) Peak to peak voltage

voltan puncak ke puncak

ii) Peak voltage

voltan puncak

iii) Period

Tempoh

iv) Frequency

Frekuensi

v) Phase shift

beza fasa

[10 marks]

[*10 markah*]

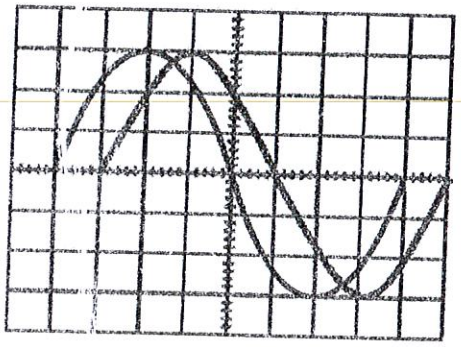


Figure C 1 (b)/*Rajah C 1(b)*

(c) A basic D'arsonval movement meter with an internal resistance of 75 ohm and a full scale deflection current of 2 mA is connected in the circuit of Diagram 11. The circuit is used in the design of DC Ammeter with the current ranges of 0-100mA.

Sebuah meter pe gerakan asas D'arsonval dengan rintangan dalaman 75Ω dan arus pesongan kala penuh 2 mA di sambung seperti litar di dalam Rajah 11. Litar ini digunakan dalam merekabentuk DC Ammeter dengan julat arus 0-100mA.

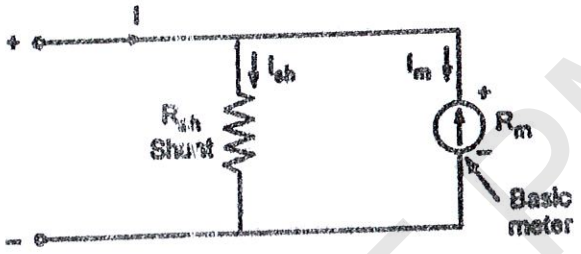


Figure C 1 (c)*Rajah C 1(c)*

Derive the equation to determine the shunt resistance, R_{Sh} and calculate the value of shunt resistor, R_{sh} required in Diagram 11.

Terbitkan persamaan untuk mengira rintangan pirau, R_{Sh} dan kirakan nilai rintangan pirau, R_{sh} yang diperlukan di dalam Rajah C 1 (c)

[4 marks]
[4 *markah*]

(d) If the Ammeter were designed into two range Ammeter circuit with shunt resistor, R_1 provides a range of 10mA and R_2 for 50mA. Draw the designof the ammeter circuit that consists of R_1 and R_2 and calculate the R_1 and R_2 values.

Jika rekabentuk Ammeter di atas di tukarkan kepada litar Ammeter dua julat dengan intangan pirau, R_1 memberikan julat 10mA dan R_2 untuk julat 50mA. Lukiskan rekabentuk litar Ammeter yang mengandungi R_1 dan R_2 dan kirakan nilai R_1 dan R_2 tersebut.

[6 marks]
[6 *markah*]

QUESTION 2
SOALAN 2

CLO2 C2

a) Wheatstone Bridge is used to measure resistance value. Explain the operation for Wheatstone Bridge.

Wheatstine Bridge digunakan untuk mengukur sesuatu perintang. Terangkan operasi tetimbang Wheatstone.

[10 marks]
[*10 markah*]

CLO2 C3

Refer to Figure C 2 Wheatstone Bridge circuit

Merujuk kepada Rajah C 2 litar Tetimbang Wheatstone.

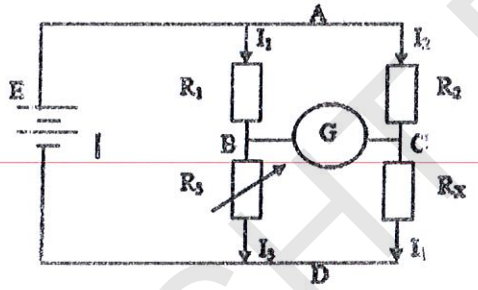


Figure C 2/*Rajah C 2*

Prove that $Rx = \frac{R2R3}{R1}$

Buktikan bahawa $Rx = \frac{R2R3}{R1}$

[5 marks]
[*5 markah*]

CLO2 C1

(c) i. Draw a schematic circuit of a wattmeter.

Lakarkan gambarajah litar skematik sebuah meter jangka watt.

CLO2 C2

ii. Explain the principle of wattmeter.

Terangkan prinsip meter jangka watt.

[10 marks]
[10 markah]

SOALAN TAMAT