

POLITEKNIK
Jabatan Pengajian Politeknik

EXAMINATION AND EVALUATION DIVISION
DEPARTMENT OF POLYTECHNIC EDUCATION
(MINISTRY OF HIGHER EDUCATION)

ELECTRICAL ENGINEERING DEPARTMENT

FINAL EXAMINATION
JUNE 2012 SESION

EE101: MEASUREMENT

DATE : 21st NOVEMBER 2012 (WEDNESDAY)

DURATION : 2 HOURS (2.30PM – 4.30PM)

This paper consists of **TWELVE (12)** pages including the front page.

Section A1: Objective (20 Questions)

Section A2: Fill in the blank (10 Questions)

Section B : Structure (10 Questions)

Section C : Essay (2 Questions)

Answer all questions.

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DO NOT OPEN THIS QUESTION PAPER UNTIL INSTRUCTED
BY THE CHIEF INVIGILATOR

(The CLO stated is for reference only)



SECTION A (20 MARKS)**SECTION A 1: OBJECTIVE QUESTIONS (1-10)**

Instruction: This section consists of TEN (10) questions. Mark your answers in the answer booklet.

1. *"This element convert the output signal from primary sensing element to another more suitable variable while preserving the information content of the original signal."*

This statement is referred to

[CLO 2]

- A. Variable Manipulation Element
- B. Variable Transmission Element
- C. Data Presentation Element
- D. Variable Conversion Element

2. *"The degree of exactness of a measurement compared to the expected value, or the most probable value, of the variable being measured."*

This statement is referred to

[CLO 1]

- A. Precision
- B. Relative accuracy
- C. Accuracy
- D. Significant figure

3. This force causes the pointer to move from its zero position when the current flows.

[CLO 1]

- A. Deflecting force
- B. Controlling force
- C. Damping force
- D. Oscillating force

4. A Permanent Magnet Moving Coil (PMMC) instrument with a 100 turn coil has a magnetic flux density in its air gaps of $B = 0.5 \text{ T}$. The coil dimension are $D = 1 \text{ cm}$ and $L = 1.5 \text{ cm}$. Calculate the torque on the coil for a current of 2 mA .

[CLO 2]

- A. $1500 \mu\text{Nm}$
- B. $150 \mu\text{Nm}$
- C. $15 \mu\text{Nm}$
- D. $1.5 \mu\text{Nm}$

5. The amplitude read on an oscilloscope of 1V/div is 1.5 cm on vertical axis.
The value of amplitude in V is [CLO 1]
- A. 1.5 V
B. 5 V
C. 1 V
D. 0.15 V
6. A Function generator can produce these types of waveforms, EXCEPT [CLO 1]
- A. Square wave
B. Triangle wave
C. Sine wave
D. Pulse wave
7. The _____ is used to measure the value of resistance below $1\ \Omega$. [CLO 1]
- A. Standard bridge
B. Kelvin bridge
C. Wheatstone bridge
D. H bridge
8. From the Figure 1, calculate the value of R_4 in a Wheatstone Bridge when $R_1 = 400\ \Omega$, $R_2 = 5\text{K}\Omega$, $R_3 = 2\text{K}\Omega$ [CLO 2]

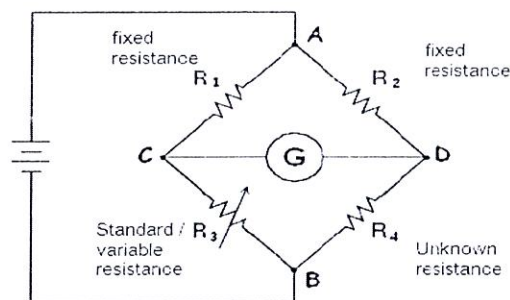


Figure 1

- A. $160\ \Omega$
B. $25\text{ k}\Omega$
C. $37.5\text{ k}\Omega$
D. $250\text{ k}\Omega$

SECTION A2: FILL IN THE BLANKS (QUESTIONS 11- 20)

Instruction: This section consists of **TEN (10)** fill in the blank questions. Write your answers in the answer booklet.

11. The human error in reading or using the instrument is known as _____ [CLO 1]
12. _____ is used to check and calibrate general laboratory instrument for accuracy and performance or to perform comparison measurement in industrial applications. [CLO 2]

Questions 13 and 14 refer to Figure 2.

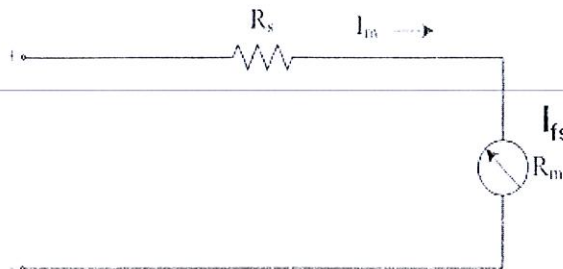


Figure 2

13. Name the circuit in **Figure 2** _____ [CLO 1]
14. Based on **Figure 2**, the CORRECT formula for multiplier resistor (R_s) is _____ [CLO 1]
15. The instrument shown in the **Figure 3** is _____ [CLO 1]

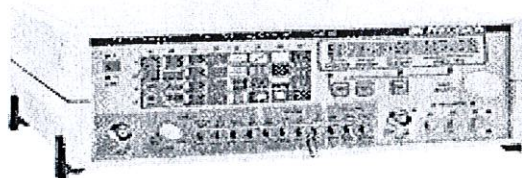


Figure 3

16. **Figure 4** shows a sine wave produced with volt/div 5mV. The value for peak-to-peak voltage for the sine wave is _____ [CLO 1]

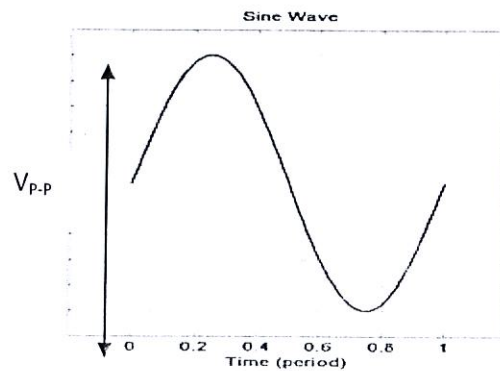


Figure 4

17. When the Wheatstone bridge is in a balanced condition, the galvanometer reading for the voltage is _____ [CLO 1]
18. By referring to **Figure 5**, R_a is the unknown resistance that needs to be measured. The formula of R_a is _____ [CLO 2]

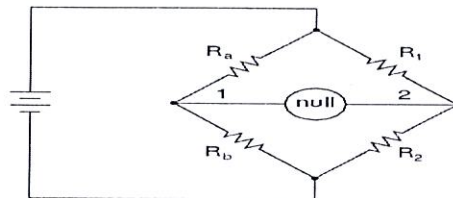


Figure 5

19. **Figure 6** is a schematic symbol of _____ [CLO 1]



Figure 6

20. Figure 7 is an electrodynamic wattmeter circuit. Which parts of the circuit are connected in series with the load?

[CLO 2]

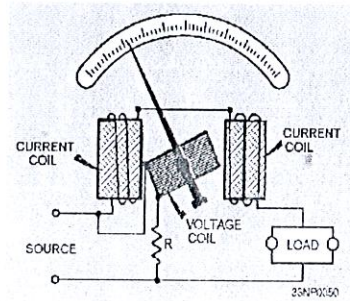


Figure 7

SECTION B**STRUCTURED (30 MARKS)**

Instruction: This section consists of **TEN (10)** questions. Answer **ALL** questions in the answer booklet.

QUESTION 1

The expected value of the voltage across a resistor is 6.7 V. However, measurement yields a value of 6.9V. Calculate the relative error. [CLO 1]
(3 marks)

QUESTION 2

Given a Permanent Magnet Moving Coil (PMMC) instrument with 900Ω coil resistance with, Full Scale Deflection (FSD) of 15mA is to be used as a DC Voltmeter with the range of 0 – 100V. Calculate the multiplier resistance R_S ? [CLO 2]
(3 marks)

QUESTION 3

Modify the circuits in [CLO 1]
(3 marks)

- Figure 8** for the measurement of the voltage drop across the resistor R_2
- Figure 9** for the measurement of the current flow through R_1 .

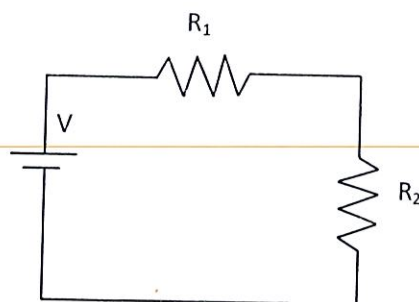


Figure 8

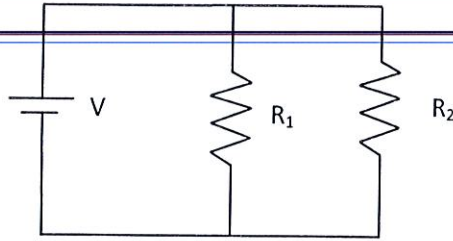


Figure 9

QUESTION 4

Differentiate the scale of Ohm and Ampere in an analog multimeter.

[CLO 2]

(3 marks)

QUESTION 5

State the **THREE (3)** advantages of an analog meter type.

[CLO 1]

(3 marks)

QUESTION 6

List **THREE (3)** parts of an Oscilloscope Block Diagram.

[CLO 1]

(3 marks)

QUESTION 7

From the **Figure 10** below, label the V_{pp} and V_p .

[CLO 1]

(3 marks)

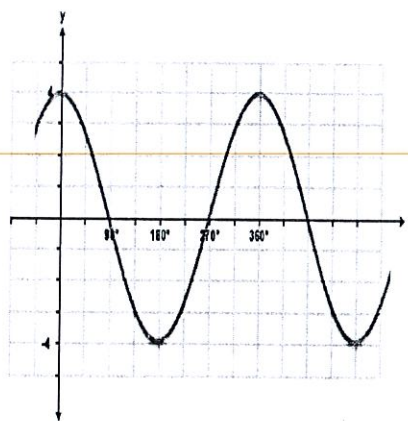


Figure 10

QUESTION 8

What would the waveform display on its screen if the waveform shown in **Figure 11** were applied to the screen and the input coupling switch was set to the following

- DC position
- AC position
- GND position

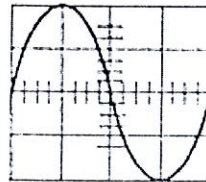


Figure 11

CLO2: C3
(3 marks)

QUESTION 9

Name **TWO (2)** types of DC Bridges.

-
-

[CLO 1]
(3 marks)

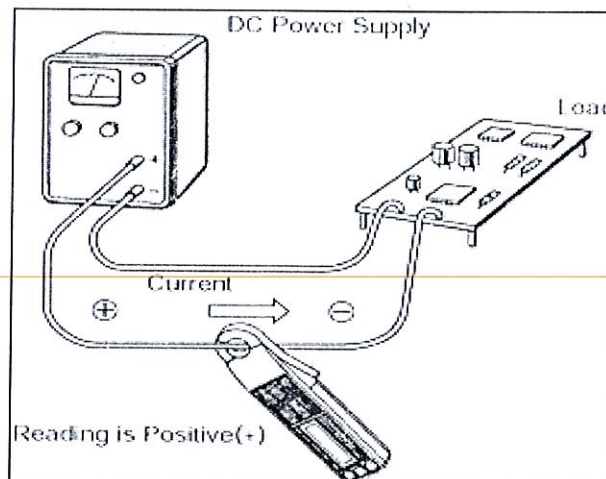
QUESTION 10

Figure 12

Based on the **Figure 12**, explain the operation of the meter .

[CLO 2]

(3 marks)

SECTION C**ESSAY (50 marks)**

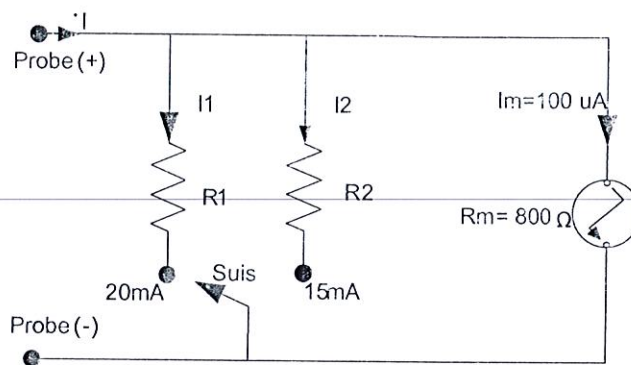
Instruction: This section consists of **TWO (2)** questions. Answer **ALL** questions in the answer booklet.

QUESTION 1

- a) A Permanent Magnet Moving Coil (PMMC) meter was connected to the various ranges as below. Referring to **Figure 13**, derive an equation for R_1 and R_2 (shunt resistor).

[CLO 2]

(8 marks)

**Figure 13**

- b) Referring to **Figure 13** calculate the value of resistor R_1 and R_2 if the current range is at 20mA and 15mA.
- c) State 3 safety precautions when using an ammeter.
- d) Design and label a basic series type ohmmeter for resistance measurement

[CLO 2]

(10 marks)

[CLO 2]

(3 marks)

[CLO 2]

(4 marks)

QUESTION 2

An oscilloscope is a useful and versatile laboratory instrument used for studying wave shapes of alternating current and voltage as well as for measurement of any quantity that involves amplitude and waveform.

- a) List **TWO (2)** type of oscilloscopes [CLO 2]
(2 marks)
- b) Draw the block diagram of each type mentioned in (a) [CLO 2]
(10 marks)
- c) **Figure 14** represents the display screen of an oscilloscope. Use the volt/div and time/div settings to calculate [CLO 2]

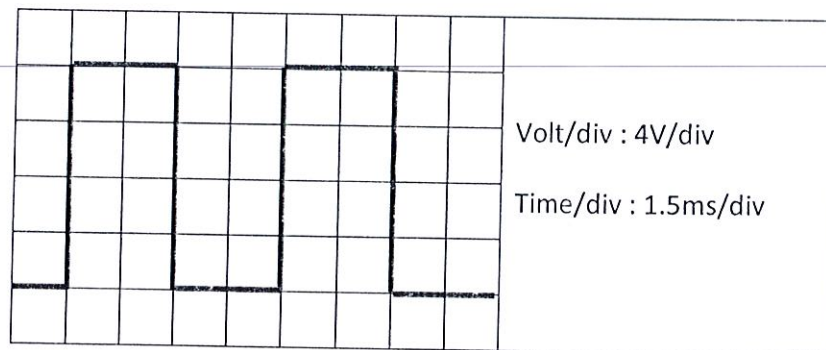


Figure 14

- i. Peak voltage (V_p) (2 marks)
 - ii. Peak to Peak Voltage (V_{p-p}) (2 marks)
 - iii. Time Period (T) (2 marks)
 - iv. Frequency (F) (2 marks)
-
- d) Define the function of the following controls [CLO 2]
 - i. Power ON/OFF (1 mark)
 - ii. Intensity Control (1 mark)
 - iii. Trigger Level knob (1 mark)
 - iv. Time/Div Selector switch (1 mark)
 - v. CAL 0.5V terminal (1 mark)