UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2017/2018

COURSE NAME	:	ELECTRICAL MEASUREMENTS
COURSE CODE	:	BEF 23903
PROGRAMME CODE	:	BEV
EXAMINATION DATE	:	JUNE / JULY 2018
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

TERBUKA

THIS QUESTION PAPER CONSISTS OF **SIX (6)** PAGES

Q1 (a) AC Bridge can be used to measure the value of unknown inductance and capacitance.

(i) Specify the construction of AC Bridge and draw the general form of AC Bridge.

(4 marks)

(ii) Differentiate between AC Bridge and DC Bridge.

(2 marks)

(b) Maxwell's Bridge in **Figure Q1(b)** is used to measure an unknown inductive impedance. The bridge constants balance are $C_I=0.5$ μF, $R_I=1000$ Ω, $R_2=600$ Ω, and $R_3=400$ Ω.

(i) Calculate the unknown impedance R_x and L_x.

(6 marks)

(ii) Draw the equivalent series circuit of the unknown impedance.

(2 marks)

(iii) If the supply frequency is 1 kHz, calculate the coil quality factor, Q of the unknown impedance.

(2 marks)

(iv) Distinguish the advantages and disadvantages of Maxwell's bridge for inductive impedance measurement.

(4 marks)

Q2 (a) Current Transformer (CT) is mainly used for the measurement of large currents in AC circuit.

(i) State at least **three (3)** advantages of using CT.

(6 marks)

(ii) With the aid of table, explain **two (2)** types of error in CT.

(4 marks)

(b) Consider a CT that has one turn on primary and 120 turns on secondary winding, is connected to a line of 50 Hz. The secondary current is 15 A and the inductive load connected to a secondary of CT is 2.0 Ω. The magnetomotive force and cross-section of the core area are 80 AT and 500 mm² respectively.
By neglecting the effects of magnetic leakage and iron losses, calculate:

(i) The turns ratio of the transformer windings.

(2 marks)

CONFIDENTIAL

(ii)   The secondary voltage.

(2 marks)

(iii)   The maximum flux in the core.

(2 marks)

(iv)   The flux density in the core.

(2 marks)

(v)   The magnetizing current.

(2 marks)

Q3   (a)   The range of electrostatic voltmeters can be increased by using resistance potential divider and capacitance potential divider.

(i)   Draw the configuration of resistance potential divider.

(2 marks)

(ii)   Distinguish **one (1)** advantage and **one (1)** disadvantage of both resistance and capacitance potential divider for high voltage measurements.

(4 marks)

(iii)   An electrostatic voltmeter in **Figure Q3 (a)(iii)** has a capacitance of 0.2 μF and full-scale deflection of 10 kV. Calculate the value of series capacitance for full-scale deflection of 132 kV.

(4 marks)

(b)   (i)   Explain **two (2)** purposes of potential transformer (PT) in high voltage measurement.

(2 marks)

(ii)   Construct a circuit diagram of PT connection for high voltage measurement.

(2 marks)

(iii)   A PT rated 14.4 kV/115 V is used to measure the line voltage. If voltmeter at secondary of the PT indicates 110 V, determine the value of line voltage.

(2 marks)

(c)   Differentiate **two (2)** main features of electromagnetic voltage transformer (EVT) and capacitive voltage transformer (CVT).

(4 marks)

Q4 (a) (i) Differentiate the circuit configuration of three-voltmeters and three-ammeters methods for power measurement in single-phase AC circuit.

(4 marks)

(ii) Explain **one (1)** disadvantage of the measurement methods in **Q4(a)(i)**.

(2 marks)

(b) Several methods can be used for the measurements of power in three-phase AC circuit. Construct a circuit diagram for three-phase power measurement using two wattmeter method.

(3 marks)

(c) Two wattmeter are used to measure power input to a 2.0 kV, 50 Hz, 3-phase motor running at the full load at efficiency of 90%. If the wattmeter reading are 300 kW and 100 kW respectively. Calculate,

(i) the input and output power.

(4 marks)

(ii) the power factor and line current.

(4 marks)

(d) Sketch the circuit connection of power measurement in high voltage using wattmeter in conjuction with instrument transformer.

(3 marks)

Q5 (a) Resistance can be classified into **three (3)** types. In a table, list and define all types by giving the correct value.

(6 marks)

(b) Ammeter-voltmeter method is the simplest method and very commonly use for measurement of low resistance.

(i) Sketch the circuit of ammeter-voltmeter method.

(2 marks)

(ii) Give **one (1)** limitation of using ammeter-voltmeter method.

(2 marks)

(c)   Explain **two (2)** possible errors in low resistance measurement.

(6 marks)

(d)   Guard wire is very important for high resistance measurement. Sketch a circuit for high resistance measurement with the guard wire and point out its function.

(4 marks)

-   **END OF QUESTIONS** -

FINAL EXAMINATION

SEMESTER / SESSION   : II 2017/2018   PROGRAMME CODE   : BEV
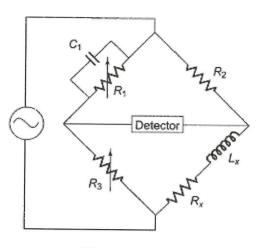COURSE   : ELECTRICAL MEASUREMENTS   COURSE CODE   : BEF23903
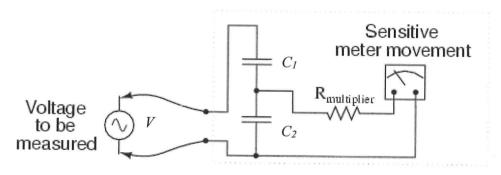

Figure Q1(b)

Figure Q3(a)(iii)

CONFIDENTIAL