TECHNICAL UNVERSITY OF MOMBASA

Faculty of Engineering & Technology

DEPARTMENT OF ELECTRICAL & ELECTRONIC ENGINEERING

DTIE 4/DTIE 4/DICE 4

ECI 2202: MEASUREMENT & FAULT DIAGNOSIS

SPECIAL/SUPPLEMENTARY EXAMINATION
SERIES: OCTOBER 2014
TIME: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer Booklet*

This paper consists of **FIVE** questions. Answer any **THREE** questions
All questions carry equal marks

Maximum marks for each part of a question are as shown
This paper consists of **THREE** printed pages

Question One

a) Explain the following terms as used in measurements:
- **(i)** Primary fundamental units
- **(ii)** Auxiliary fundamental units
- **(iii)** Derived units **(6 marks)**

b) (i) Derive the dimensional of force in terms of fundamental units
(ii) Express coulombs law of the force exerted between two charges Q1 and Q2 distance d apart and hence derive the dimensional equations of charge. **(8 marks)**

c) With the aid of a diagram, explain how magnetic density is measured by hall effect method. **(6 marks)**

Question Two

a) (i) State FIVE sources of instruments errors.
(ii) Explain the classification of indicating instruments. **(8 marks)**

b) Define the following:
- **(i)** Precision
- **(ii)** Accuracy

c) (I) Explain the following in instruments.
- **(i)** Shunt
- **(ii)** Multiplier

(II) Determine the ammeter modification to provide the range 0 – 5A, for a basic meter movement with an internal resistance of 730 Ω and full scale deflection current 5mA **(8 marks)**

Question Three

a) Explain the following errors and the methods of minimizing them:
- **(i)** Gross errors
- **(ii)** Systematic errors
- **(iii)** Random errors **(10 marks)**

b) Explain the half split method of fault diagnosis. **(4 marks)**

c) Explain the phases of corrective maintenance. **(6 marks)**

Question Four

a) With the aid of a diagram explain the measurement of resistance by the substitution method and explain why the accuracy of the meter does not affect the result. **(8 marks)**

b) (i) List THREE detectors used for a.c brides.

(ii) Figure 1 shows the arms of an Maxwell's bridge at balance. $R_2 = R_3 = 100\ \Omega$. Determine the resistance and inductance of the coil. **(12 marks)**

Question Five

a) Explain the following failures:
   (i) Catastrophic
   (ii) Degradation
   (iii) Inherent weakness **(6 marks)**

b) Explain the following: **(6 marks)**
   (i) MTBF
   (ii) Reliability
   (iii) Maintainability
   (iv) Availability

c) An electronic equipment has MTBF of 500 hours. Determine the probability of failure for this equipment in 100 hours of life. **(6 marks)**