PROGRAM	:	NATIONAL DIPLOMA *ENGINEERING: ELECTRICAL* *ENGINEERING: COMPUTER SYSTEMS*
SUBJECT	:	**MEASUREMENTS III**
CODE	:	**EMA3111**
DATE	:	SUMMER EXAMINATION 2015 9 NOVEMBER 2015
DURATION	:	(SESSION 1) 08:30 - 11:30
WEIGHT	:	40: 60
TOTAL MARKS	:	100

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NUMBER OF PAGES	:	4 PAGES

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INSTRUCTIONS TO STUDENTS

1.   ATTEMPT ALL QUESTIONS.
2.   100 MARKS = 100%.
3.   MARKS WILL BE DEDUCTED FOR UNTIDY AND UNREADABLE WORK.
4.   ALL DIAGRAMS AND SKETCHES MUST BE DRAWN NEATLY AND IN PROPORTION.
5.   ALL DIAGRAMS AND SKETCHES MUST BE LABELED CLEARLY.
6.   QUESTIONS MAY BE ANSWERED IN ANY ORDER, BUT ALL PARTS OF A QUESTION MUST BE KEPT TOGETHER.
7.   THE MULTIPLE CHOICE QUESTION MUST BE ANSWERED ON THE MULTIPLE-CHOICE ANSWER SHEET INSIDE THE ASSESSMENT SCRIPT.
8.   **QUESTION PAPERS MUST BE HANDED IN WITH EXAMINATION SCRIPTS.**

SECTION A   MULTIPLE CHOICE

This section is to be answered at the back of your assessment script, on the multiple-choice answer sheet. Choose the most correct answer and mark an **X** over the corresponding letter on multiple-choice answer sheet. (*Rough work can be done at the back of the answer script*).

QUESTION 1

1.1   The three primary sets of oscilloscope controls are
         A) Vertical, Measurements and Display
         B) Horizontal, Auto set and Measurements
         C) Vertical, Horizontal and Trigger
         D) Trigger, Measurements and Cursors

1.2   Oscilloscopes can make measurements with:
         A) Automated measurements using firmware-based algorithms to process stored waveform data
         B) Cursor measurements
         C) Manual measurements based on the graticule of the display
         D) All the above

1.3   A typical digital oscilloscope
         A) Conditions analog input signals with amplification.
         B) Samples the input signals at a high sample rate and converts them to digital format.
         C) Stores the digitized waveform data in memory and displays the waveform on the display.
         D) All the above Cloud

QUESTION 1 (Continued)

1.4   The first parameter to consider when choosing an oscilloscope is?
     A)   Size
     B)   Record Length
     C)   Bandwidth
     D)   Number of Measurements

1.5   Using the display's graticule, measure the following:
     A)   frequency of the signal
     B)   peak-to-peak voltage
     C)   period of the signal
     D)   all of the above

1.6   Using the oscilloscope's automated measurements, measure the following:
     A)   peak-to-peak voltage
     B)   period of the signal
     C)   frequency of the signal
     D)   none of the above

1.7   A digital oscilloscope acquires a waveform by conditioning:
     A)   the input signal in the analog vertical amplifier,
     B)   sampling the analog input signal,
     C)   converting the samples to a digital representation with an analog-to-digital converter
     D)   all of the above

1.8   The horizontal scale control:
     A)   center's the waveform on the screen
     B)   sets the time window displayed on the oscilloscope screen
     C)   align the displayed waveform
     D)   controls the amount of voltage represented

1.9   The vertical position knob
     A)   controls the position of the waveform on the vertical axis
     B)   moves the waveform up and down
     C)   It is generally used to align the waveform with the vertical divisions on the graticule
     D)   All of the above

1.10   Period mode used in frequency counters is used for
     A)   frequencies lower than the clock pulse frequency
     B)   frequencies higher than the clock pulse frequency
     C)   number of cycles lower than the clock pulse frequency
     D)   number of cycles higher than the clock pulse frequency

QUESTION 1 (Continued)

1.11   The main application/s of a network analyzer
     A)   It determines the horizontal position on the display
     B)   the DC levels set the starting frequency on the output and the
           modulating oscillators
     C)   the amplitude sets the frequency range for the test signal and the
           modulating oscillator
     D)   All of the above

1.12   The rise time of a 100-MHz bandwidth oscilloscope is
     A)   35 ns
     B)   3.5 ns
     C)   0, 35 ns
     D)   none of the above

1.13   The accuracy of an instrument is
     A)   the difference between a measured value and an estimated value
     B)   difference between higher calibration values to lower calibration
            values
     C)   the difference between a measurement reading and the true
            value of that measurement.
     D)   the smallest possible change in value that can be measured
            by the instrument

1.14   Pink noise is:
     A)   constant in amplitude and evenly spread over a specific bandwidth
     B)   constant in amplitude and evenly spread over a specific bandwidth.
     C)   the amplitude is inversely proportional to the frequency and the noise
            is evenly spread over the total spectrum of frequencies
     D)   the amplitude is inversely proportional to the frequency and the noise is evenly
            spread over a specific bandwidth

1.15   Band-Limited White noise is:
     A)   constant in amplitude and evenly spread over the total bandwidth
     B)   constant in amplitude and evenly spread over a specific bandwidth
     C)   where the amplitude is not evenly spread over a specific bandwidth
     D)   where the amplitude is inversely proportional to the frequency

1.16   Binomial distribution is an event that has
     A)   Two possibilities
     B)   more than two possibilities
     C)   nominal possibilities
     D)   no possibilities

1.17   Normal Distribution is
     A)   the same as Poisson distribution
     B)   where the results are totally random
     C)   where the results are in a sequence
     D)   where the results are distributed

QUESTION 1 (Continued)

1.18   The Correlation Coefficient will always be:
        A)   between -1 and +1
        B)   between 0 and +1
        C)   equal to 1
        D)   none of the above

1.19   To reduce measurement errors in Ammeters, the internal resistance should be
        A)   as high as possible
        B)   a low resistance value
        C)   one ohms
        D)   should be zero

1.20   a DC Ammeter should always be connected:
        A)   in series
        B)   in parallel
        C)   across a voltage source
        D)   across a large current.

                                                                                [20]

SECTION B

This section is to be answered in your answer script.

QUESTION 2

2.   Two instruments are used to measure a current of 145 mA.
        The readings for **instrument A** were as follows:
        Deviations from the true value for **instrument A** are:

Reading	145, 09	145, 19	144, 91	144, 79	144, 79	144, 91
Deviation	0. 09	0, 19	0, 09	0, 21	0, 21	0, 09

Maximum deviation is **0, 21**
The readings for **instrument B** were as follows:
Deviations from the true value for **instrument B** are:

Reading	144, 73	144, 61	144, 70	144, 79	144, 76	144, 73
Deviation	0. 27	0, 39	0, 30	0, 21	0, 24	0, 27

Maximum deviation is **0, 39**
Calculate:

2.1   The **accuracy** for both instruments (A and B);   (2)
2.2   the **average** for both instruments (A and B)   (4)
2.3   the **precision** for instrument A and the **precision** for instrument B (6)

                                                                                [12]

QUESTION 3

3.1   Discuss the functions of the time base on a network analyzer   (3)

3.2   Use a block diagram to show how a wave meter can be extended to
        become a spectrum analyser.   (8)

3.3   Explain the use of a vector network analyzer with the use of a
        connecting diagram   (8)

                                                                            [19]

QUESTION 4

4.1   Compare eight different ways in which pattern triggers can be used.   **[16]**

QUESTION 5

5.1   A multi-range DC voltmeter must be constructed for 10 V, 20 V and
        50 V ranges. The basic instrument has an internal resistance of 10 Ω and
        2 mA current causes full-scale deflection. Calculate the required series resistors
        for both combinations.   (6)

5.2   A series connected ohmmeter has a total internal resistance of 1 MΩ and uses two
        standard 1, 5 Volt cells. Calculate:

5.2.1   The scale mark values in Ω, for
        50 % and 75 % of FSD: (Full Scale Deflection).   (4)

5.2.2   The percentage deflection for 100 kΩ and 500 kΩ (2)

                                                                            [12]

QUESTION 6

6.   Explain the factors that will introduce errors in bridge measurements.

                                                                             [7]

QUESTION 7

7.1   An oscilloscope is an electronic test instrument that displays electrical signals graphically, usually as a voltage versus time. Discuss eight common measurement applications for an oscilloscope.   (8)

7.2   A digital oscilloscope has 8 vertical divisions and the gain is set to 100m V/div, Calculate the resolution if the ADC produces:

7.2.1   Eight bits per sample and
7.2.2   Sixteen bits per sample   (6)

[14]

TOTAL = 100