



**PROGRAM** : NATIONAL DIPLOMA  
*ENGINEERING: ELECTRICAL*  
*ENGINEERING: COMPUTER SYSTEMS*

**SUBJECT** : MEASUREMENTS III

**CODE** : EMA3111

**DATE** : SUMMER SSA EXAMINATION 2015  
8 DECEMBER 2015

**DURATION** : (SESSION 1) 08:00 - 11:00

**WEIGHT** : 40: 60

**TOTAL MARKS** : 100

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**ASSESSOR** : MR EM LOOTS

**MODERATOR** : MR J SEBASTIAN

**NUMBER OF PAGES** : 4 PAGES

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2235

### **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 GROUPED TOGETHER.
7. **QUESTION PAPERS MUST BE HANDED IN WITH EXAMINATION SCRIPTS.**

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**QUESTION 1 - TRUE OR FALSE STATEMENTS**

*Negative marking applies for this question.*

*Answer true for a statement which you agree with and false to statements that you disagree with. A correct answer results in one mark allocated to you while an incorrect answer will result in half a mark being deducted*

- |      |   |     |
|------|---|-----|
| 1.1  | A Hay Bridge is a type of DC bridge circuit similar to a Wheatstone bridge.   | T/F |
| 1.2  | A medical researcher can use an oscilloscope to measure brain waves.  | T/F |
| 1.3  | Bandwidth is the frequency range of the oscilloscope, usually measured in Megahertz (MHz).                                      | T/F |
| 1.4  | Rise time is the time taken by a step or a pulse to rise from 30 % to 70 % of its amplitude level.                              | T/F |
| 1.5  | The trigger level knob controls the position of the waveform on the vertical axis.  | T/F |
| 1.6  | The horizontal position knob allows you to align the displayed waveform with the horizontal divisions of the display graticule. | T/F |
| 1.7  | A trigger defines when a signal is acquired and stored in memory.   | T/F |
| 1.8  | Cursor measurements use algorithms stored in the oscilloscope's firmware.   | T/F |
| 1.9  | Active probes are used for very high frequency measurements.  | T/F |
| 1.10 | A current probe is connected directly to the circuit.   | T/F |

**[10]**

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**QUESTION 2**

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|-----|---|-----|
| 2.1 | Differentiate between the four different trigger modes used by digital oscilloscopes. | (8) |
| 2.2 | Explain the three input coupling methods.   | (3) |
| 2.3 | State the advantages a scope probe provides when using digital oscilloscopes.         | (2) |

**[13]**

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**QUESTION 3**

- 3.1 Describe the principle actions of a spectrum analyzer. (5)
- 3.2 Discuss two different types of wave meters (6)
- [11]**
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**QUESTION 4**

- 4.1 Explain an important property of the exponential distribution (4)
- 4.2 State the difference between regression and correlation (4)
- 4.3 Differentiate between variance and standard deviation. (4)
- 4.4 A batch of 200  $\mu\text{F}$  capacitors with a tolerance of + 20 % was tested.  
The following values were obtained during the test:  
188  $\mu\text{F}$ , 174  $\mu\text{F}$ , 191  $\mu\text{F}$ , 198  $\mu\text{F}$ , 175  $\mu\text{F}$ , 183  $\mu\text{F}$ , 200  $\mu\text{F}$ , 195  $\mu\text{F}$ ,  
189  $\mu\text{F}$ , 216  $\mu\text{F}$   
Determine:
- 4.1.1 the standard deviation,  
4.1.2 the average and  
4.1.3 the variance. (6)
- [18]**
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**QUESTION 5**

- 5.1 Differentiate between voltmeter loading effect and ammeter loading effect of an instrument. (6)
- 5.2 If the specifications of a standard ammeter are given as 60  $\Omega$  and 2 mA, Calculate the values of the shunt resistors for an instrument with ranges of 2 A, 20A and 50 A full-scale deflection. Use both types of design. (6)
- 5.3 A series connected ohmmeter has a total internal resistance of 30 k $\Omega$  and uses a standard 5 V cell.
- 5.3.1 Calculate: The scale mark values in  $\Omega$ , for 25 %, 50 % and 75 % of FSD: (Full Scale Deflection).
- 5.3.2 The percentage deflection for 1 k $\Omega$ , 10 k $\Omega$ , 100 k $\Omega$ . (6)

**[18]**

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**QUESTION 6**

- 6.1 How can frequency dividers be used to extend the range of a frequency counter. (5)
- 6.2 Define the terms precision and repeatability. (4)
- 6.3 What is meant by practical standards? (3)
- [12]**
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**QUESTION 7**

- 7.1 Sketch the bridge circuit and give the balance requirements. (4)
- 7.2 Explain the two types of comparative measurement. (4)
- [8]**
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**QUESTION 8**

- 8.1 Sketch the block diagram of a modulated output generator. **[10]**
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**TOTAL = 100**

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